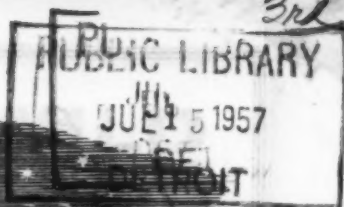


GENERAL INFORMATION

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# Current Science



Vol. 26, No. 5

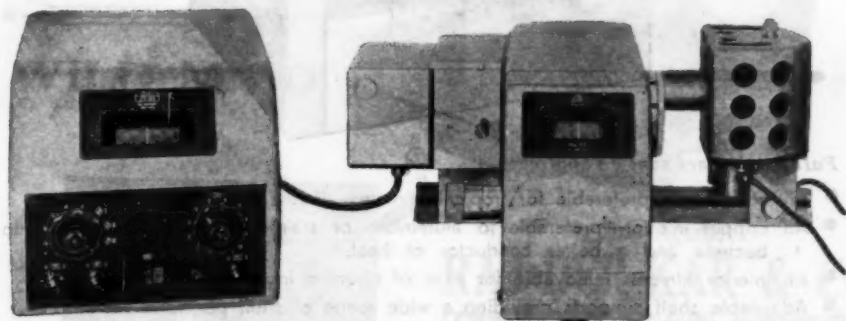
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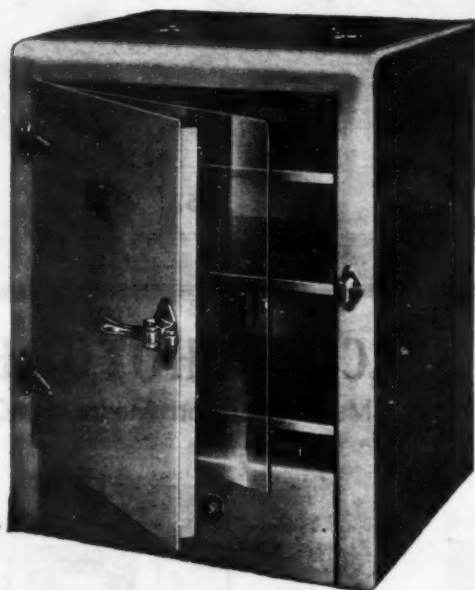
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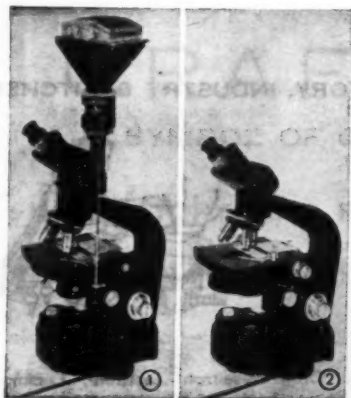
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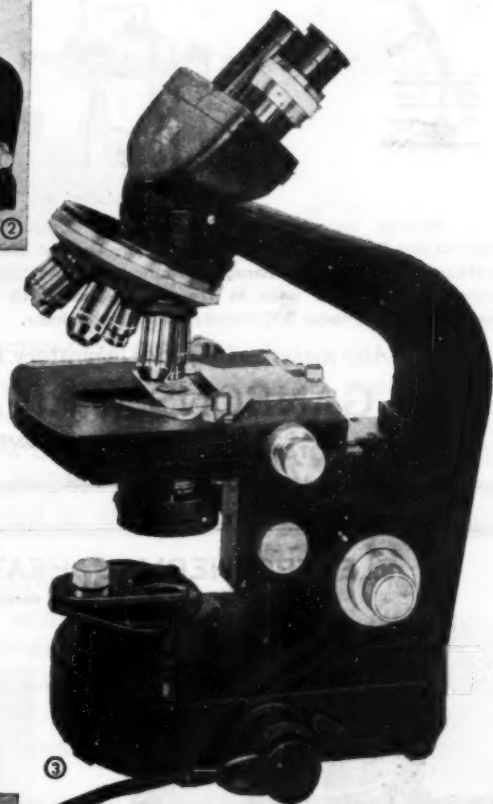


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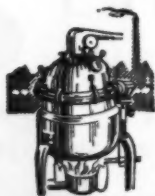
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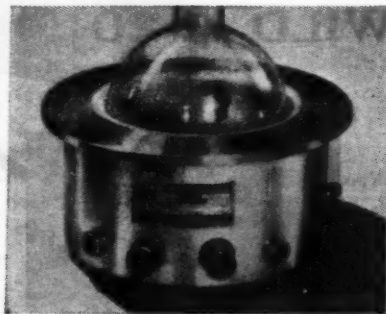
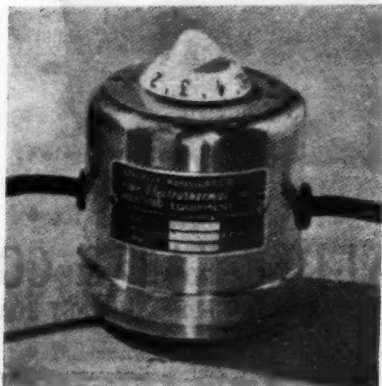
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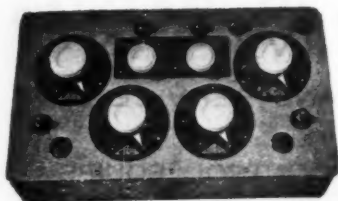
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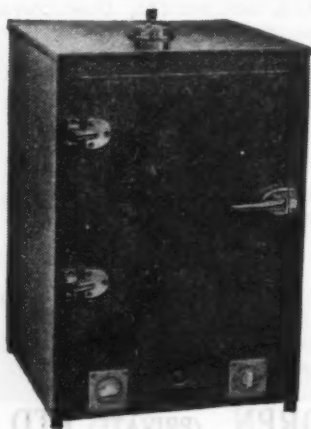
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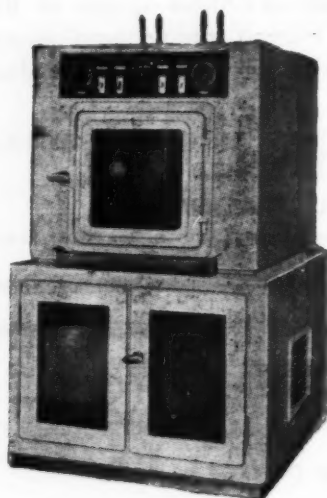
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# Current Science

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MAY 1957

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## SCIENCE, ETHICS AND POLITICS\*

THE scientist is searching for truth, for truth's sake, and, if it is found, he processes it without fear of consequences. This demands the highest ethical standards and brings him into line with the religious and moral leaders of mankind. What the scientist really wants to know are the internal laws that hold human societies together. So science is not devoid of relations to ethics and morals.

Morals are practical prescriptions that tell us how to live to be able to live together. The moral outlook of a scientist has to be wider than that of the average, simply because his society is wider, not being limited by time or space. The community in which I live has Galileo, Newton, and Lavoisier as its active members, and I cannot help feeling more affinity to Chinese or Indian scientists than I do to my own milkman.

As to politics, up till lately, there was no need for the scientist to take cognizance of its existence. However, lately, politics has penetrated not only into science but also into the private lives of individuals, forcing the scientist, too, to make a stand. That science, in certain countries, is dictated by political dictators is so crude a matter that it demands no discussion.

We all have the bad luck to be born in an age of a moral crisis, and, according to Dante, the hottest places in Hell are reserved for those who remained neutral at times of a moral crisis. So we all have to take a stand, simply as human beings. Humanity has its well-established moral code on which human relations are based. It is these moral laws that enable man to live in a society, and the problem is whether these morals apply only to the individual or also to groups of men, whether crimes which are punished by death in one country should be suffered to be practised on a big scale as

\* From an article in *Science* (1957, 125, 226), by Albert Szent-Györgyi.

a routine by governments in another country, being internal affairs. This is more than an ethical problem. As a society could not exist without a moral convention among its members, so countries cannot exist, side by side in peace, without a moral code. I am deeply convinced that this is the simple root of all our political troubles, the whole political superstructure being but a "pseudo-problem".

There is but one moral code, and, if any government rejects it inside its borders, it will reject it in its international relations as well, and create disorder. The question is whether any deviation from moral convention should be suffered by the rest of mankind. There are international laws to control pestilence, for fear that that pestilence may spread across borders. Why not the same for moral pestilence?

For most of my colleagues, these questions may seem crude and the answers so self-evident, that discussion of them is superfluous. But, political questions can come into the scientists' life also in subtler forms, making decisions more difficult. When they do, each will have to answer these questions for himself, to avoid being made into tools for purposes with which he may not agree. It may perhaps be more useful here to call attention to three psychological factors that may make the choice difficult and obscure the issue unless we have recognised them.

The first of these can be summed up by the saying, "Things are not as we see them, but we are as we see things." An honest man will think the world honest; a dishonest man, or government, will think that the rest of the world is made of criminals or warmongers. This is natural. We really know only our own mental machine, and are likely to suppose that it represents the mental machine of man. So, if honest people hear and read about crimes committed in other countries, they just do not believe it, or may believe it with their minds only, not with their hearts.

Another peculiarity of the mind is that man likes to commit his crimes and gratify his animal instincts, or craving for power, in the name of high-sounding principles. So, we cook up such principles and appoint ourselves their defenders. Men of goodwill thus are sidetracked, giving their honest consideration to the principles, instead of to the crimes. Even good ends do not justify bad means, so I keep myself to the advice, "Watch deeds, not words." In politics, I observe "acts" and lend a deaf ear to "principles" until my moral standards have been satisfied by the former.

My third, and last remark concerns the fact that the brain is not an organ of thinking, but an organ of survival, like claws and fangs. It is made in such a way as to make us accept as truth which might only be an advantage. It is an exceptional, almost pathological, constitution one has if one follows thoughts logically through, regardless of consequences. Such people make martyrs, apostles, or scientists, and mostly end on the stake or in a chair, electric or academic.

Another difficulty may lie in the fact that moral laws are not always unequivocal. If morals are the rules which make living together possible, then they may change according to the conditions under which we have to live together. Bigamy is regarded as a crime in one country, while in another it may be the rule for any self-respecting gentleman. Even the most basic rule, "Thou shalt not kill", may change from time to time. At the dawn of mankind it might have read, "Thou shalt not kill inhabitants of your own cave." Politicians would like to keep it at this level.

So, what is really needed is an international "bureau of moral standards", passing out "weights and measures". If these were generally enforced or accepted, we would march toward a more hopeful future and would not have to find consolation in the fact that, after all, our globe is but a second-rate planet and so its blowing up does not really matter.

#### DR. D. N. WADIA

DR. D. N. WADIA, Geological Adviser to the Department of Atomic Energy, has been elected a Fellow of the Royal Society in recognition of his outstanding researches into the 'geological structure of the Himalayas'. Dr. Wadia is

a Member of the Board of Scientific and Industrial Research; Chairman, Mineralogical and Geological Research Committee; and Member, Editorial Board, *Journal of Scientific and Industrial Research*.

## INVESTIGATION OF DIELECTRICS AND SEMICONDUCTORS IN THE USSR\*

ACADEMICIAN A. F. JOFFE

*Institute of Semiconductors, USSR Academy of Sciences, Leningrad*

## I. DIELECTRICS

At the beginning of this century all the electrotechnical materials were divided into two groups: conductors and insulators or dielectrics. True, it was known that not all the dielectrics were perfect insulators and that electric currents passed even through dielectrics; these currents were made an object of investigation by the French physicists, Fousereau and Jacques Curie at the close of the nineteenth century. At the beginning of the present century, the investigation of dielectrics was highly developed in Germany and Russia. The peculiarity of currents in dielectric crystals, discovered during the very first investigations, gave rise to the supposition that currents are no more than dielectric anomalies (slow displacements of ions and electron shells within the same crystal cell), similar to the phenomena which characterize the anomalies of elastic and magnetic properties.

V. R. Roentgen and A. F. Joffe proved in a number of researches published during the period 1905-29, that this hypothesis was wrong and that in dielectric crystals we deal with actual, real currents, that is, with a directed movement of charges; as to the seeming anomalies, they can be accounted for by the accumulation of space charges near the electrodes.

The research work of A. F. Joffe, A. A. Shaposhnikov, P. I. Loukirsky, M. V. Kirpicheva, B. M. Gohberg, V. A. Joffe and others has thrown light on the nature of space charges, their origin and their distribution within the crystal, the nature of current carriers (ions or admixtures of ions, of the crystal substance itself in some cases and electrons in others, particularly when connected with photoconductivity) quantitative laws, controlling the passage of the current in dielectric crystals, have been found.

These problems have acquired still greater importance in proportion with the growing requirements with regard to dielectrics, which are used in alternating current circuits and, particularly, in high frequency radiotechniques. Accordingly, the twenties and thirties were characterized by a large-scale development of

physical investigations dealing with the phenomena occurring in dielectrics.

In connection with the growing application of different plastic materials as insulators in the USSR, the electrical properties of amorphous dielectrics and polymers have come to be the object of research since the late twenties. P. P. Kobeko, E. V. Kuvshinsky, G. P. Michailov, A. P. Alexandrov, S. N. Gurkov, G. I. Skanavy and others have proved that the electrical properties are closely connected with the viscosity of these substances. The abovementioned scientists have succeeded in giving a detailed description of the processes occurring in amorphous substances, and in revealing the physical nature of the hardening temperature as well as of the influence of plastifiers on this temperature. The nature of the polymer relaxation elasticity has been studied. It is to this group of investigators belongs the discovery of the principal laws in the field of the physics of amorphous state.

In the thirties, B. M. Vul, B. M. Gohberg and their assistants investigated the electrical properties and the breakdown of gases, particularly of those under high pressure. A. F. Walter and L. D. Inge investigated during the same period of time the breakdown of fluid dielectrics.

Owing to the progress of high voltage techniques, particular attention was devoted to the problem of electrical strength and the breakdown of dielectrics. N. N. Semenov, V. A. Fok and A. F. Walter found the laws governing the breakdown, caused by the heating of a dielectric by the electric current. A great number of investigations were devoted to the study of the "electrical" breakdown. In the course of investigating the breakdown of dielectrics were found insulators of the highest quality (polystyrene) and the most stable gases ( $\text{SF}_6$ ). The hypothesis of the ionization breakdown put forward by A. F. Joffe found further confirmation. It was found that not only in electron conductors, but also in electrolytically conducting solid dielectrics, the breakdown is caused by electrons. Since that time, several theories of electrical breakdown have been put forward (Fröhlich, Hippel and others); this problem, however, cannot be regarded as solved as yet.

The rapid development of radio techniques requires a thorough investigation of energy

\* This review essentially deals with the developments in the USSR. Similar work done elsewhere is not discussed in detail.

losses in dielectrics, placed in an alternating electric field. Apart from Joule heat produced by the current, there occur also other phenomena in the electric field: both the electric dipoles that form part of many dielectrics, and the dipoles created by the field itself, turn in the direction of the field; not only the electrons in atoms and molecules are displaced, but also the positive and negative ions, forming the crystal lattice of ionic crystals. Each of these phenomena influences both the value of the dielectric constant of the dielectric and the quantity of the losses occurring in it.

At the beginning of the thirties, I. V. Kurchatov and P. P. Kobeko discovered a new phenomenon that proved to be of great practical importance. In crystals of Rochelle salt (Seignette salt), as well as in other similar crystals, the electric field creates polarization, which exceeds by many hundred and thousand times what had been observed in dielectrics up to that time. The dielectric constant of Rochelle salt is measured in terms of thousands of units. Kurchatov and Kobeko proved that the electrical polarization of Rochelle salt resembles the magnetic polarization of ferromagnetic materials (in particular: saturation, residual electrification, hysteresis, the temperature at which these properties disappear, similar to the Curie point for ferromagnetics, etc.).

I. V. Kurchatov and L. D. Landau have also proved that, as in the case with ferromagnetics, there are domains in Rochelle salt composed of thousands of molecules with similarly oriented electric dipoles, which turn simultaneously in the electric field. By analogy with the ferromagnetics, such substances have been named "seignettelectrics". In foreign literature they have been given the less characteristic name of ferroelectrics.

In the forties, B. M. Vul discovered a new group of seignettelectrics—barium titanates with a lattice of the perovskite type. The Curie point for this group lies above  $100^{\circ}\text{C}$ ., whereas for the Rochelle salt it is  $24^{\circ}$ , which limited the use of the material for technical purposes.

The barium titanates, like Rochelle salt, possess piezoelectric qualities—mechanical deformation produces electric dipoles in them and conversely, the electric field causes deformation. Unlike Rochelle salt, the barium titanates become piezoelectrics as a result of preliminary electrification, which directs the electric dipoles of most of the domains along the field. Owing to this, it is possible to impart piezoelectric properties not only to a separate

monocrystal, but also to a polycrystalline aggregate obtained as a result of ceramic treatment. This discovery, made by B. M. Vul, aroused great interest, and many articles and papers were devoted to it in the USA, England and Germany.

In the fifties, G. A. Smolensky and his assistants still further enlarged the group of seignettelectrics.

G. I. Skanavi synthesized and studied such dielectrics which possess high dielectric constants amounting to hundreds of units, not as a result of their grouping into domains, but due to the easy displacement of ions that form part of them, as for instance titania, tungsten trioxide, molybdenum trioxide, and other crystals with the structure of rutile and perovskite. Ceramics containing similar crystalline substances have found wide application in condensers.

## II. ELECTRON SEMICONDUCTORS

The investigation and wide practical application of semiconductors is a matter of the recent twenty-five years.

The electron semiconductors fill in a tremendous area of electrotechnical materials that lie between the insulators with specific resistance above  $10^{10}$  ohm cm. and metals with resistance below  $10^{-5}$  ohm cm. From the point of view of chemical composition, certain elements (graphite, silicon, germanium, selenium, tellurium, boron, arsenic, phosphorus) are also semiconductors, as well as oxides, sulfides, selenides, tellurides, certain alloys and the like.

More than 10,000 papers have already been devoted to the investigation of semiconductors; their application in engineering and in national economy has been growing yearly and daily; in proportion with this has grown the variety of materials that are being used for technical purposes.

In the history of semiconductors, short in time but rich in events, the interconnection of science and technique has clearly revealed itself.

The first technical items were rectifiers and photoelectric cells of cuprous oxide and selenium; it is these materials and these phenomena that had been the object of careful and close investigation in the succeeding years. Thallous sulphide and cadmium sulfide have been thoroughly studied in connection with photo-resistance; lead sulfide, lead selenide and lead telluride were investigated in the war and post-war years. Thorium dioxide, cesium stibide and calcium oxide have been investigated in connection with the requirements of vacuum techniques.

The protection of high voltage lines from thunder storm discharges has drawn the attention of scientists to carborundum and to the investigation of the contact between its separate grains. The use of semiconductors for measuring temperature, for automatic regulation and for switching on electric systems has resulted in a systematic investigation of the temperature dependence of electrical conductivity of such materials as uranium dioxide, vanadium pentoxide, and a number of sulphurous compounds. The so-called electrolytic condensers, formed by layers of aluminium oxide, have given rise to literature devoted to the properties of similar oxides. The variety of semiconductors investigated began to grow considerably when their role in luminescence and catalysis was appreciated.

During the war, germanium and silicon were applied in the USA for radio location purposes. Since that time, these materials have become the main objects of investigation. They have found still wider application in radio techniques, by replacing vacuum detectors, amplifiers and generators of high frequency oscillation. Thousands of investigations in the USA, England, USSR, Germany, France, Holland and Switzerland have revealed all the details in the properties of germanium and silicon. It is on these data that the general quantum theory of semiconductors has been based. The properties of germanium and silicon are known better than those of any other semiconductors, even better than those of such classic materials as cuprous oxide, which were the main objects of investigation in pre-war physics.

In connection with the possibility of applying semiconducting thermocouples to convert thermal power into electrical power, to produce cold and for other purposes, semiconductors of low resistance are being studied in the USSR; their theory is being developed and their electric, thermal and mechanical properties investigated. In this connection, the attention of Soviet scientists was drawn to the investigation of the mechanism of thermal conductivity and the laws that control it. The research work of A. V. Joffe, E. D. Devyatkova, P. V. Gulyaev and others have proved the connection of thermal conductivity with atomic weight, with the nature of chemical bonds, the influence of admixtures and the correlation of thermal conductivity with the mechanism of the passage of electric current.

With the help of a sealing layer (barrier layer), it is possible to produce electric power not only during the illumination of the photo-

electric cell but also under the action of radioactive radiation, which, similar to light, increases considerably the concentration of electrons in the semiconductor.

In the field of magnetism, semiconductors also reveal new possibilities. Semiconductors, constructed after the spinel type, possess as high ferromagnetic properties as iron. But their electrical resistance is high—in this respect they differ from iron. As a result of this, the electromotive force induced in them by the alternating magnetic field excites comparatively weak currents, and accordingly does not lose much energy. Energy losses limit the utilization of metal ferromagnetics with a high frequency alternating current. The use of iron, even with the usual 50-cycle current, requires special conditions. The iron has to be divided into thin isolated layers or it has to be used in powder form, placed in an insulating medium. The semiconducting ferromagnetic materials, called ferrites, may be successfully applied in alternating magnetic fields, up to a frequency of  $10^6$  hertz.

We may also mention here some of the results of the investigation of semiconductors in the USSR.

Among theoretical problems, the theory of excitons—excitation state of electrons, which have not passed into a free state—put forward by J. I. Frenkel in 1931 is of great interest. The exciton can diffuse in the crystal lattice and give its energy to the lattice or to the electron when encountering admixture atoms of crystal anhomogenetics. The existence of excitons accounted for the possibility of light absorption without the appearance of free electrons. Some time later, E. F. Gross proved experimentally the appearance of the exciton during light absorption by cuprous oxide crystals, by crystals of cadmium sulfide and the like. He studied their spectra, the influence of electric and magnetic fields and revealed the mechanism of the appearance of certain spectral lines.

The theory of the photoelectric cell with a sealing layer was worked out by V. E. Lashkarev, who proved the possibility of obtaining considerable efficiency when converting light power into electric power. U. P. Maslakovetz and B. T. Kolomietz have made a photoelectric cell out of thallous sulfide with a sensitivity 20 times greater than that of selenium and with an efficiency for sunlight up to one per cent.

Recently they have been working at the photoelectric cell on the basis of silicon and germanium with a higher efficiency, amounting to 5 per cent. and more.

I. K. Kikoin and M. M. Noskov have discovered the photomagnetic effect. When a cuprous oxide plate placed in a magnetic field at the temperature of liquid air is illuminated, great electromotive forces arise in it amounting approximately to 15 volts, and in liquid helium even reaching 100 volts.

The behaviour of semiconductors in strong electric fields, where Ohm's law proves to be inapplicable, has been investigated by A. V. Joffe. It has been proved that the concentration of free electrons greatly increases in such fields, whereas the mobility of electrons changes but little. The theory of this phenomenon has been further developed by J. I. Frenkel.

U. K. Pojela has found conditions under which a rise in the concentration of free charges, created by the strong field or light in a certain section of the semiconductor, may be used for amplifying purposes.

The most important problem of pre-war engineering—the rectification of the alternating current—has been the object of detailed investigation in the USSR. The theory of this phenomenon has been worked out by B. I. Davidov, and later by Schottky in Germany and Mott in England. A. V. Joffe has proved by experiments the connection between the properties of the sealing layer, which forms in the place where the semiconductor borders on the metal, with the difference of contact potential between them. In spite of Schottky's theory, she showed, even before the war of 1941-45, that the strong current asymmetry (thousands and tens of thousands times stronger in one direction than that in the opposite one, while the difference of potential applied to the rectifier is the same), that is observed in technical rectifiers, arises not on the borderline of the metal, but between two semiconductors, with different conduction mechanisms (usually denoted as conduction mechanism of the P or N type). The theory of rectification on the boundary of two semiconductors was developed on this basis by A. I. Gubanov. The transfer of this boundary into monocrystals of germanium and silicon, which has been achieved during the war years in the USA, has called to life new techniques for radio-instruments, making use of semiconductors (diodes, triodes, generators of radio waves).

As to theoretical investigations, the polaron theory of S. I. Pekar is of great interest. Pekar gives the name of polaron to an electron,

whose field has polarized the ambient medium. In ionic crystals, the displacement of ions around the charge reduces its power by several tenths of electron volts, which leads to the prevalence of polarons over free electrons in such crystals. Proceeding from his theory, Pekar has also accounted for the properties of the so-called F-centres, which colour transparent crystals of rock-salt and other ionic crystals when they are lighted by X-rays or when the crystals are heated in sodium or potassium vapour.

The investigations of A. R. Regel have proved to be of considerable importance for the understanding and utilization of semiconductors. These investigations showed that the specific properties of semiconductors are inherent not only in the solid crystal state, but are also preserved after the crystals melt and pass into a fluid amorphous state. A. F. Joffe, V. P. Youze and their assistants have proved that a number of metal alloys such as  $MgSO_3$ ,  $Cs_3Sb$ ,  $ZnSb$ ,  $Mg_2Sn$  are typical semiconductors. Of no less significance are V. P. Youze's investigations dealing with the problem of the physical properties of semiconductors in relation with their crystal-chemical structure and bond energy.

In conclusion, we should like to point out a number of experimental investigations of A. F. Joffe, U. R. Maslakovitz, E. D. Devyatkov, L. S. Stilbans, A. N. Voronin and the theoretical investigations of T. A. Kontorova, that formed the basis for thermoelectric generators and refrigerators. A generator of that kind, which utilizes the heat emerging from the glass of a kerosene lamp as a source of electricity for a radio set, is produced by the Soviet industry for use in distant regions and places where they do not yet use electric power.

Thermocouples made of semiconductors as well as photoelectric cells with a sealing layer may be utilized in order to convert solar energy into electric power with an efficiency that at present amounts to 5-6 per cent. With the help of semiconducting thermocouples, house refrigerators and other cooling apparatuses are being made.

A considerable number of Soviet physicists persistently work at the problem of semiconductors, their theory and technical application. There are laboratories where the investigation of semiconductors is being carried on, both at the Institutes of the Academy of Sciences and Universities, and industrial institutions.

## VARIABILITY IN PROTEIN CONTENT OF RICE

S. SAMPATH AND D. V. SESHU

Central Rice Research Institute, Cuttack

IN view of the nutritional importance of protein in rice, analyses were made of different kinds of rice, to ascertain the genetic variability in the percentage of protein in them. The results appear to be significant and are presented here.

A number of workers have analysed the common varieties of rice and have recorded the results. For instance, Aykroyd et al.<sup>1</sup> find the protein content in Indian samples to vary from 6.6 to 8.5% and Fraps<sup>2</sup> found 9.13% protein in an American brown rice. Ishizuka and Tanaka<sup>3</sup> drew the following conclusions from analyses of rice from different parts of Japan and from different manurial treatments. Grain protein from State Experiment Stations' samples ranged from 6.25 to 8.08% and was higher in the north than in the south. The protein content can be raised by manuring in excess of 50 kg. N per acre and more efficiently so in water cultures, where with 200 p.p.m. of N, the grains showed 14.2% protein.

In the present work, samples were secured from plots which had been green manured only. One gram of air-dry hand-husked grains were used for each estimation. Kjeldahl's method was used and the factor 6.25 was used to convert nitrogen percentage to protein percentage. A random check with duplicate samples showed that the figures were consistent to the first decimal place. The results given in Table I suggest that rice types with long sterile lemma ("glumes") have a higher protein content than the commoner types having short sterile lemma. To secure evidence for this correlation, samples were taken from the  $F_2$  of a hybrid between short-glumed (No. 6 of Table I) and long-glumed (No. 11 of Table I) types. The segregants with long sterile lemma (Nos. 17, 18, 19 and 20 had more protein than those with short sterile lemmas (Nos. 7, 8, 9 & 10). This character of long sterile lemma was selected for detecting correlation, because it is a distinctive genetic character and lemma characters are used in the taxonomy of *Oryza*.

It was also found that tetraploid *O. sativa* synthesized in this Institute had higher protein content than the cultivated diploids. However the tetraploids grown were poor-yielding and not suited for cultivation. Similarly the wild species *O. australiensis* has more protein than is common in rice. This species has not yet been crossed with *O. sativa*. A continuation of

this work, namely, the study of response of varieties with long sterile lemma to intensive manuring, has been started.

TABLE I

No.	Type	Protein %
Cultivated short-glumed rices:		
1	T. 90 (Orissa)	8.7
2	C-34.14 (Burma)	8.6
3	Baok (Java)	8.1
4	G.E.B. 24 (Madras)	7.7
5	Dj Mudjahir (Indonesia)	6.5
6	A.C. 780 (C.R.R.I. Collection)	7.9
7	$F_2$ of (No. 6 x No. 11) — I	7.4
8	do. — II	8.5
9	do. — III	7.9
10	do. — IV	7.9
	Mean ..	7.9
Long-glumed rices:		
11	A.C. 1224 (C.R.R.I. Collection)	9.7
12	Extract from (Indica x Japonica) — I	10.6
13	do. — II	9.7
14	do. — III	9.6
15	ACC. 597 (C.R.R.I. Collection)	10.3
16	<i>O. glaberrima</i> (Long-glumed)	9.8
17	$F_2$ of (No. 6 x No. 11) — V	9.4
18	do. — VI	11.3
19	do. — VII	10.1
20	do. — VIII	10.4
	Mean ..	10.0
Tetraploids:		
21	Auto of Seta (Thailand)	12.2
22	Auto of Indrasail (Bengal)	11.5
23	Auto of S.R. 26 B. (Orissa)	10.8
24	Hybrid—Tet. 20	13.3
25	Hybrid—Tet. 17	10.7
Wild rices:		
26	<i>O. australiensis</i> (Australia)	10.1
27	<i>O. breviligulata</i> (W. Africa)	9.5
28	<i>O. perennis</i> (Cuttack)	8.7
29	<i>O. glaberrima</i> (W. Africa)	8.3
30	<i>O. perennis</i> (short gl.) (Sudan)	7.8

We are indebted to Shri R. Seetharaman for providing the  $F_2$  plants of long x short-glumed rice, and to the Director, Central Rice Research Institute, for facilitating this work.

1. Aykroyd, W. R., et al., *Health Bulletin*, 1951, Govt. of India, 23.
2. Fraps, G. S., *Texas Agric. Expt. Sta. Bulletin*, 1946, 680.
3. Ishizuka, Y. and Tanaka, A., *J. Sci. Soil and Manure*, Japan, 1950, 21, 23; 1951, 22, 1; and 1953, 24, 173.

## STRONTIUM-90 IN MAN

**R**ADIOACTIVE fallout at great distances from atomic explosions produces both internal and external hazards to the human race. The external hazards result from the interaction of gamma rays in the environment on the genes of individuals, which produces an increased mutation rate. The internal hazard is primarily the development of bone cancer, because of the presence of strontium-90 (half-life 28 years). Libby has discussed the general problem of strontium-90 in fallout and has presented considerable data on the concentration of this isotope in various parts of the chain from the atmosphere to man.

In a recent article in *Science* (1957, 125, 219), J. Laurence Kulp, Walter R. Eckelmann, Arthur R. Schulert present the results obtained at Lamont Geological Observatory on the strontium-90 content in man (based on a worldwide sampling network), and attempt to evaluate the potential hazard.

At the present time strontium-90 can be found in all human beings, regardless of age or geographic location, provided that a sample of adequate size is available. These quantities are small, compared with the maximum permissible concentration (MPC) (1.0 millimicrocuries of strontium-90 per gram of calcium) established by the National Committee on Radiation Protection.

The worldwide average strontium-90 content of man was about 0.12 micromicrocurie per gram of calcium (1/10,000 of the maximum permissible concentration) in the fall of 1955. A few values as high as 10 times the average have been obtained. This value is in accord with the predicted value based on fallout measurements and fractionation through the soil-plant-milk-human chain. With the present burden of strontium-90, this average level should rise to 1 to 2 micromicrocuries of strontium-90 per gram of calcium by 1970.

## BOTANICAL SURVEY OF INDIA, WESTERN CIRCLE, POONA-4

**D**URING the year 1956-57, the Botanical Survey of India, Western Circle, conducted plant explorations in the unexplored areas of North Kanara, Kerala, Khandesh, Poona, Kolaba, Satara, Kutch, Saurashtra and Aravallis, during the different seasons.

In all, over one hundred excursions were made and all types of vegetation including forests, grasslands, aquatic plants and all groups of plants including phanerogams and cryptogams were collected. Collections of plants were made extensively from different habitats and in different stages of growth. Most of the areas surveyed are unexplored botanically, and the collections that are being studied promise to yield data of far-reaching importance from systematic, phyto-geographic, ecological and sociological point of view. Revision and amplification of Cooke's Bombay Flora is in hand. The collections during the year exceed 14,000 plants. The plants have been collected mostly in replicates of five or six, and after mounting two sheets for the Herbarium, and leaving one or two for the Central National Herbarium, there are still two or three species of each plant available for exchange purposes.

The Herbarium contains about 50,000 sheets of Cooke's and Talbot's collections of late nineteenth and early twentieth century. The new collections of 1956-57 number more than 8,000 sheets properly identified and arranged according to the Bentham and Hooker classification. Attached to the Herbarium is a well-developed museum which contains 200 specimens of seeds and fruits collected during the year 1956-57; 60 specimens of tree barks, 40 specimens of fungi, lichens, mosses; 30 specimens of woods; and about 200 maps, charts, pictures, etc. The Herbarium maintains an excellent collection of photographs taken during the year of different types of vegetation and plants, numbering more than 800.

The Western Circle also offers facilities to University teachers and students for identification of their collection and has arranged lectures and short courses on methodology of plant exploration and survey and ecological studies. Medicinal and other economic plants were supplied to a number of institutions. The institution is fast expanding, and greater facilities would be available to scientists and the interested public for research, study and intelligent recreation during the year 1957-58.

## INTERNATIONAL CONFERENCE ON SCIENTIFIC INFORMATION

THE National Science Foundation, the American Documentation Institute, and the National Academy of Sciences—National Research Council are sponsoring an International Conference on Scientific Information to be held in Washington, D.C., early in November 1958.

There has been much comment about the increasing difficulties in scientific communication arising from the increasing tempo of research activity and the resulting flood of scientific publications. The sponsors believe that an international conference is warranted at this time to provide for a thorough discussion of present developments and research pertaining to the organization and dissemination of scientific information, with special emphasis on storage and retrospective research.

The subject-matter to be covered at the Conference will be grouped in the following general areas: (1) Requirements of scientists for scientific literature and reference services: knowledge now available and methods of ascertaining their requirements. (2) The function and effectiveness of abstracting and indexing services for storage and retrieval of scientific information and possible development of such

services. (3) Effectiveness of scientific monographs, compendia, and specialized information centres for storage and retrieval of scientific information: survey of present practices, trends, and new and proposed techniques and types of services. (4) Organization of information for storage and retrospective search: comparative characteristics of existing systems. (5) Organization of knowledge for storage and retrospective search: conceptual and mechanical problems in the design of new systems. (6) Organization of information for storage and retrospective search: possible development of a general theory of storage and search. (7) Responsibilities of governmental bodies, professional societies, universities and research and industrial organizations for research and training in scientific documentation and for operation of scientific information services.

All requests for further information should be addressed to the Executive Secretary, Dr. Alberto F. Thompson, International Conference on Scientific Information, National Academy of Sciences—National Research Council, 2,101, Constitution Avenue, Washington-25, D.C.

## ROCKEFELLER FOUNDATION AGRICULTURAL PROGRAMME

THREE closely related types of activities constitute the agricultural programme of the Rockefeller Foundation during the year 1956-57. One is the direct operation by staff members and their local associates of research and demonstration projects leading to the improvement of food crops of major importance to the host country. Four such projects are now in operation: in Mexico, Colombia and Chile, and the new one in India.

The second is a system of fellowships, scholarships, and travel grants designed to enrich the experience and broaden the training of selected younger scientists. Many of the fellows and scholars have had preliminary training under the supervision of staff members in one of the operating centres. More than 400 Latin American graduates of agricultural colleges have had advanced training experience of this sort in the 14 years of the system's operation, and already a number of the earlier appointees have returned and been advanced to positions of responsibility in ministries of

agriculture, colleges of agriculture, research agencies, and private industry; a number of them are themselves helping in the training of a still younger generation of technicians and scientists.

The third aspect of the work consists of grants to universities and other institutions for the support of education and research in the agricultural sciences. The grants are oriented toward agricultural education leading to the production of increased number of qualified graduates, toward the application of agricultural techniques to crop and animal improvement, or toward the support of fundamental research with potential long-range benefits to agricultural science and production. In seeking these objectives, the Foundation has made grants to Faculties of Agriculture in Latin America and Asia, both for the strengthening of instruction and for the expansion of research activities. The grants made to institutions in the United States and Europe have, in general, emphasized research of a very fundamental type.

## LETTERS TO THE EDITOR

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## ON THE RATE OF ULTRASONIC EMULSIFICATION

THOUGH much data have been accumulated on the process of emulsification through ultrasonic irradiation, no systematic analysis of the data, especially on the exact processes of dispersion and coagulation, seems to exist, apart from a few scattered theories,<sup>1</sup> which have not been tested fully.

In general one can write the equation for the concentration of the emulsion produced under the opposing influences of dispersion and coagulation in the form:

$$\frac{dc}{dt} = \alpha - \beta c^n$$

where  $\alpha$  and  $\beta$  are experimental constants. Considering the collisions of the particles of the emulsion, if the probability that a collision results in the coagulation of the two particles is  $\sim 1$ , then the reaction would proceed as a sim-

ple bimolecular reaction, viz.,  $n = 2$ . But if this probability is  $\ll 1$ , then a monomolecular reaction,  $n = 1$ , will occur. Reactions of types other than these two dynamically simplest types, are quite unlikely.

The general solution of such an equation (with the boundary condition  $c = 0$  at  $t = 0$ ) is difficult to obtain, but the particular cases of  $n = 1, 2$  are of interest here. With  $n = 1$ , one integrates the equation as:

$$c = c_{\infty} (1 - e^{-at})$$

and with  $n = 2$ , the integral is:

$$c = c_{\infty} \tanh bt$$

where  $c_{\infty}$  is the limiting concentration at large time,  $a$  and  $b$  are constants related to  $\alpha$  and  $\beta$ .

The solutions immediately show that the concentration at first rises sharply but very soon levels off to a constant value  $c_{\infty}$  as is found to be the case experimentally. But sufficiently accurate results are not available to distinguish

between the two concentration rates which agree with each other to the terms in the first degree in  $t$ . A comparison can be made with the best data of Bondy and Söllner<sup>2</sup> on toluene-sodium oleate solution system. From the experimental observations, the limiting concentration is fixed up quite accurately by extrapolation, which is only over a small range, as the observations extend to fairly large times. The solutions can be written in the form:

$$\log_e (c_{\infty}/c_{\infty} - c) = at$$

$$\tanh^{-1} (c/c_{\infty}) = bt$$

and the values of  $\log_e (c_{\infty}/c_{\infty} - c)$  and

$\tanh^{-1} (c/c_{\infty})$

are plotted against  $t$ , as shown in Fig. 1 enabling the linear relation to be tested and the

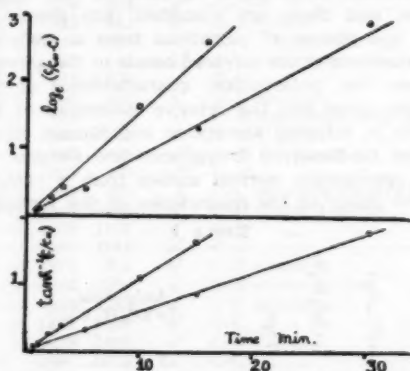


FIG. 1.

constants to be evaluated. It is seen that both the solutions agree with the experiment almost equally well, the accuracy of the experiment not being sufficient to resolve between the two solutions.

A full treatment of the problem is hampered by the lack of information about the intensity distribution in the volume where the emulsification takes place, the exact contributions of dispersion, coagulation and agglomeration and the particle-size variation. Experiments designed to elucidate these points have been initiated in our laboratories.

The author takes this opportunity to thank Professor R. S. Krishnan and Dr. V. S. Venkatasubramanian for encouragement and assistance.  
Dept. of Physics, E. S. RAJAGOPAL.  
Indian Institute of Science,  
Bangalore-3, February 15, 1957.

1. Bergmann, L., *Der Ultraschall*, Berlin, 1954.

2. Bondy, C. and Söllner, K., *Trans. Faraday Soc.*, 1930, 32, 556.

## YOUNG'S MODULUS OF SHORT WIRES AND FIBRES

A NUMBER of methods are available for the measurement of Young's modulus of long specimens but hardly a few are found for short ones. The method described here makes use of the optical device described by Perfect<sup>1</sup> for setting two opposed and opaque mirrors parallel. The instrument is described in Fig. 1. C is a

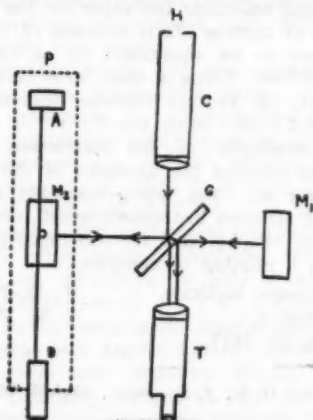


FIG. 1

collimator giving a parallel beam of light. G is half-silvered glass plate inclined to the incident beam at  $45^\circ$ .  $M_1$  and  $M_2$  are two plane mirrors. The path of light is shown in the figure. The telescope (T) receives two images of the small hole H, one direct and the other after reflection from the mirrors  $M_1$  and  $M_2$ . When the two images coincide the mirrors  $M_1$  and  $M_2$  are parallel. When the mirror  $M_2$  rotates the reflected image moves away from the direct image. Since the optical device is capable of detecting a rotation of one minute of arc or even less, the method of measuring the Young's modulus is sufficiently sensitive.

The arrangement of the wire AB and the mirror  $M_2$  is shown separately in Fig. 2. The

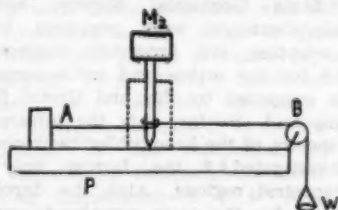


FIG. 2

wire is clamped at A and is taken round the axle of the mirror  $M_2$ . This arrangement avoids

strain on the bearings of the axle when the loads are applied. The mirror  $M_2$  can be rotated freely and the position of the image could be adjusted on any division of the graduated scale provided in the telescope. The direct image was usually kept in the centre of the scale and the reflected one was allowed to move from one end of the scale to the other.

The instrument was calibrated by a wire of pure copper assuming the value for the Young's modulus of copper. Each division of the scale was found to be equivalent to an elongation of  $9 \times 10^{-5}$  cm. Using a steel wire of diameter 0.0137 cm., its Young's modulus was measured to be  $20.2 \times 10^{11}$  dyne cm.<sup>-2</sup>

The sensitivity of the instrument can be varied by varying the diameter of the axle of the mirror  $M_2$ . The whole assembly makes a rigid and compact instrument which, when once calibrated, can be used for the rapid measurement on a number of samples.

M. G. Science Institute,  
Ahmedabad-9,  
February 25, 1957.

P. D. PATHAK.  
I. M. PATEL.

1. Perfect, D. S., *J. Sci. Instr.*, 1948 **25**, 15.

# INFRARED AND RAMAN SPECTRA OF ORTHO- AND META-FLUOROBROMO, FLUOROiodo AND BROMOCHLOROBENZENES

FOLLOWING the general programme of studying the vibrational spectra of the dihalogenated benzenes of the type  $C_6H_4XY$ , the infrared spectra of ortho-fluoriodo- and bromochlorobenzenes, meta-fluorobromo-, fluoriodo- and bromochlorobenzenes and the Raman spectra of ortho- and meta-fluoriodo and bromochlorobenzenes have been investigated in continuation of similar work on ortho- and meta-fluorobromobenzenes reported earlier.<sup>1</sup> The fluorobenzenes were kindly presented by Dr. G. C. Finger of the Illinois State Geological Survey, and the bromochlorobenzenes were prepared by the author, adopting the procedure suggested by Hartwell<sup>2</sup> for the ortho- and meta-compounds, and that suggested by Fry and Grote<sup>3</sup> for the para-compound. So far, only the infrared and Raman spectra of the bromochlorobenzenes have been investigated,<sup>4-9</sup> the former only over limited spectral regions. Also, the depolarisation factors for the meta-compound were not reported. In the present work the infrared spectra of all these compounds were investigated over a wider spectral range, and the

Raman spectra reinvestigated. The depolarisation factors for the meta-compound have also been obtained.

The experimental procedure adopted in the present investigations is described in the earlier reports.<sup>1</sup> The infrared spectra were obtained in the NaCl and KBr regions with different thicknesses of the liquid film; and in the case of fluorobromo and fluoriodobenzenes, the vapour phase spectra have also been investigated with a path length of 25 cm. and at pressures corresponding to the saturated vapour pressures of the liquids at the laboratory temperature (28° C.).

The observed infrared and Raman bands have been interpreted in terms of 30 fundamental vibrational frequencies of each of the molecules, and these are classified into planar  $\sigma'$  and non-planar  $\sigma''$  vibrations from a study of the contours of the infrared bands in the gaseous phase, the polarisation characteristics of the Raman lines and the relative intensities of the bands in infrared absorption and Raman effect. These fundamental frequencies are assigned to the appropriate normal modes from a comparative study of the magnitudes of the frequen-

TABLE I

$\sigma'$ -FC <sub>6</sub> H <sub>4</sub> Br	$\sigma'$ -FC <sub>6</sub> H <sub>4</sub> I	$\sigma'$ -ClC <sub>6</sub> H <sub>4</sub> Br	Type	Assignment ( $\sigma'$ -XC <sub>6</sub> H <sub>4</sub> Y)
157	144	142	$\sigma''$	C-Y non-planar bending
189	166	165	$\sigma''$	C-Y planar "
262	252	231	$\sigma''$	C-X non-planar "
298	252	281	$\sigma''$	C-C-C planar "
437	434	436	$\sigma''$	C-C-C non-planar "
471	460	461	$\sigma''$	C-C-C planar "
530	527	522	$\sigma''$	C-C-C non-planar "
546	541	386	$\sigma'$	C-X planar "
653	640	441	$\sigma'$	C-Y stretching
695	694	688	$\sigma''$	C-C-C non-planar bending
751	752	746	$\sigma''$	C-H "
791	781	807	$\sigma''$	C-H "
821	819	719	$\sigma''$	C-C stretching (breathing)
850	849	856	$\sigma''$	C-H non-planar bending
937	937	945	$\sigma''$	C-H "
1025	1020	1036	$\sigma''$	C-C-C planar "
1049	1040	1021	$\sigma''$	C-H "
1115	1110	1122	$\sigma''$	C-H "
1156	1156	1161	$\sigma''$	C-H "
1233	1231	645	$\sigma''$	C-X stretching
1261	1259	1252	$\sigma''$	C-H planar bending
1285	1279	1269	$\sigma''$	C-C stretching
1446	1443	1434	$\sigma''$	C-C "
1479	1472	1455	$\sigma''$	C-C "
1579	1581	1570	$\sigma''$	C-C "
1591	1581	1570	$\sigma''$	C-C "
1020	3021	2900	$\sigma'$	C-H "
3065	3072	3064	$\sigma'$	C-H "
3085	3072	3064	$\sigma'$	C-H "
3174	3164	3138	$\sigma'$	C-H "

cies in the different molecules. These data are given in Tables I and II for the ortho- and meta-compounds respectively.

The author is deeply indebted to Prof. K. R. Rao for his kind and valuable guidance.

TABLE II

$m\text{-FC}_6\text{H}_4\text{Br}$	$m\text{-FC}_6\text{H}_4\text{I}$	$m\text{-ClC}_6\text{H}_4\text{Br}$	Type	Assignment ( $m\text{-XC}_6\text{H}_4\text{Y}$ )
175	160	167	$a''$	C-Y non-planar bending
206	179	205	$a''$	C-Y planar "
244	241	205	$a''$	C-X non-planar "
308	260	301	$a''$	C-C-C planar "
439	433	433	$a''$	C-C-C non-planar "
480	478	554	$a''$	C-C-C "
521	520	342	$a'$	C-X planar "
555	545	519	$a''$	C-C-C planar "
615	617	596	$a''$	C-C-C non-planar "
672	672	670	$a''$	C-H "
666	650	421	$a''$	C-Y stretching "
774	774	773	$a''$	C-H non-planar bending "
860	847	756	$a''$	C-C-C planar "
860	860	868	$a''$	C-H non-planar "
969	969	970	$a''$	C-H "
1002	999	995	$a''$	C-C stretching (breathing) "
1055	1040	1068	$a'$	C-H planar bending "
1082	1079	1101	$a'$	C-H "
1155	1157	1164	$a'$	C-H "
1217	1213	654	$a'$	C-X stretching "
1204	1205	1259	$a'$	C-H planar bending "
1293	1293	1287	$a'$	C-C stretching "
1429	1422	1409	$a'$	C-C "
1475	1470	1468	$a'$	C-C "
1591	1585	1575	$2a'$	C-C "
3024	3019	3020	$a'$	C-H "
3079	3068	3065	$2a'$	C-H "
3176	3170	3128	$a'$	C-H "

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Waltair, April 8, 1957.

1. Krishnamachari, S. L. N. G., *Curr. Sci.*, 1956, **25**, 185; 260; 355.
2. Hartwell, J. L., *Org. Synthesis*, 1944, **24**, 22.
3. Fry, H. S. and Grote, I. W., *J. Amer. Chem. Soc.*, 1926, **48**, 711.
4. Lecomte, J., *J. Phys. Rad.*, 1938, **9**, 13.
5. Parodi, M., *Compt. Rend.*, 1941, **212**, 1138.
6. Kohlrausch, K. W. F. and Pongratz, A., *Monatsh. Chem.*, 1935, **65**, 198.
7. Paulsen, O., *Ibid.*, 1938, **72**, 244.
8. Hertz, E., *Ibid.*, 1946, **76**, 1.
9. Hertz, E., and Kohlrausch, K. W. F., *ibid.*, 1947, **76**, 200.

## SYNTHETIC ANALOGUES OF ROTENOIDS

ROTENOIDS are derived from chromano-chromanone system and some of them possess, in addition, either a simple furan or a substituted

dihydrofuran ring. Analogous to the latter are the dihydro-furoisoflavones. In the course of our study of furanaisoflavones<sup>1</sup> and similar synthetic analogues of rotenoids, dihydrofuro-(6:7:4":5") chromeno-(2:3:3':4')-chromone (V) and 2'-methoxy-2-methyl-(6:7:4":5")-dihydro-furoisoflavone (III) were synthesised and in the present note is attempted their comparative study. Incidentally, these two compounds possess a structure similar to that of pachyrhizon,<sup>2</sup> a new variant of rotenoid type, recently isolated from yam beans.

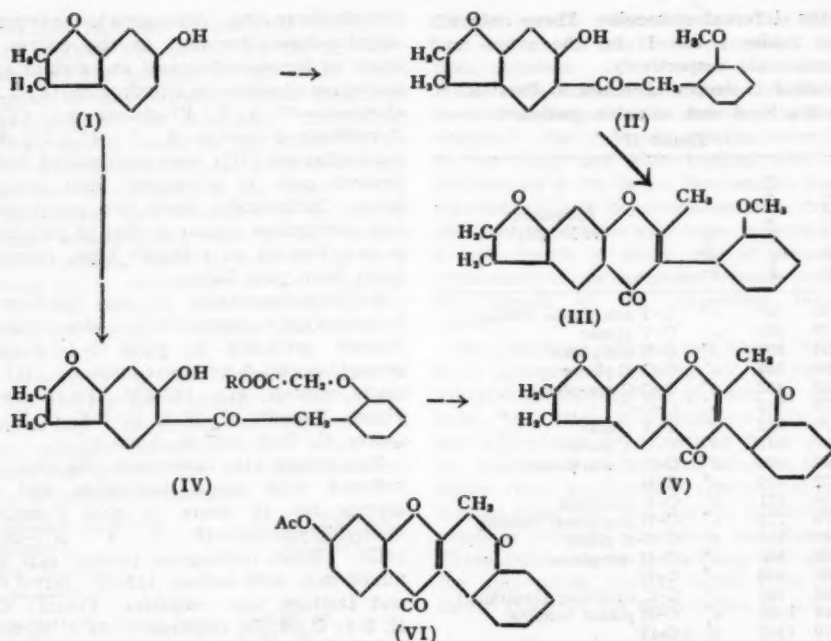
6-Hydroxycoumarin (I) was condensed with 2-methoxyphenylacetonitrile under conditions of Hoesch synthesis to yield 5-( $\omega$ -2'-methoxyphenyl)-acetyl-6-hydroxycoumaran (II) (Prismatic crystals; m.p. 142-43°. Ferric reaction: violet. Found: C, 71.8; H, 5.6; C<sub>17</sub>H<sub>16</sub>O<sub>4</sub> requires C, 71.8 and H, 5.6%.)

This ketone (II) underwent ring closure when refluxed with acetic anhydride and sodium acetate for 14 hours to give 2'-methoxy-2-methyldihydrofuro-(6:7:4":5")-isoflavone (III). (Stout, rectangular prisms; m.p. 144-45°; mixed m.p. with ketone, 112-18°; ferric reaction and Durham test: negative. Found: C, 74.5; H, 5.5; C<sub>19</sub>H<sub>16</sub>O<sub>4</sub> requires C, 74.0; H, 5.2.)

6-Hydroxycoumaran was similarly condensed with methylphenoxylacetate-2-acetonitrile under the conditions of Hoesch Synthesis. The resulting oily ketimine hydrochloride, on hydrolysis with aqueous hydrochloric acid, gave rise to a mixture of a keto-acid (IV, R=H) and a methyl keto-ester (IV, R=Me). The latter (narrow, long prismatic rods; m.p. 116-17°; ferric reaction: brown. Found: C, 66.2; H, 5.6; C<sub>19</sub>H<sub>18</sub>O<sub>6</sub> requires C, 66.7; H, 5.3%) could be hydrolysed with 2% sodium hydroxide to the former keto-acid (IV, R=H). (Transparent rectangular prisms; m.p. 164-65°; ferric reaction: brown. Found: C, 65.4; H, 5.2; C<sub>18</sub>H<sub>16</sub>O<sub>6</sub> requires C, 65.9; H, 4.9%.)

The keto-acid (IV, R=H) (390 mg.) was subjected to ring closure according to the method of Prof. Alexander Robertson<sup>3</sup> by refluxing with acetic anhydride and sodium acetate containing a few drops of glacial acetic acid when pale yellow prismatic crystals could be secured; (m.p. 213-14°; ferric reaction and Durham test: negative. Found: C, 73.9; H, 4.4; C<sub>18</sub>H<sub>12</sub>O<sub>4</sub> requires C, 74.0; H, 4.1%). The constitution of this compound, by analogy with Robertson's chromeno-chromone (VI), is given as dihydrofuro-(6:7:4":5")-chromeno-(2:3:3':4')-chromone (V).

\*Microanalysis, by Dr. K. W. Zimmermann, C.S.I.R.O. Melbourne University, Melbourne, Australia.



The ultraviolet absorption spectra of the furoisoflavone (III) and the chromeno-chromone (V) were measured in 95% ethanol using a Hilger Uvispec photoelectric spectrophotometer. To make the comparison complete, Robertson's 7-acetoxychromeno-(2 : 3 : 3' : 4')-chromone (VI) was also synthesised and its ultraviolet spectrum similarly measured.

Fig. 1 indicates that 7-acetoxychromeno-chromone (VI) possesses a characteristic broad

band of low intensity ( $\log E = 3.85$ ) between 305 and 287  $m\mu$  which modified into a definite peak at 299  $m\mu$  with a stronger absorption ( $\log E = 4.21$ ) in the dihydrofurochromeno-chromone (V). This change may be attributed to the presence of the dihydrofuran ring system in the latter. The remainder of the curves are similar in both the compounds.

The spectrum of the dihydrofuroisoflavone (III) is simple with definite maxima at 284  $m\mu$  and 306  $m\mu$ . The introduction of a chromeno system in (V), resulted in the shift of these two peaks by 10  $m\mu$  towards the shorter wavelengths.

One of us (L. R. R.) is indebted to the administrators of the Commonwealth Technical Co-operation Scheme and the Federal Government of Australia for a Fellowship during 1952, which enabled him to carry out part of this work at Melbourne University, Australia.

Dept. of Chemistry, S. K. PAVANARAM.  
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Waltair, February 14, 1957.

1. Pavanaram, S. K., Row, L. R. and Seshadri, T. R., *J. Sci. Industr. Res.*, 1956, 15 B, 195.
2. Bickel, H. and Schmid, H., *Helv. Chim. Acta*, 1953, 36, 664.
3. Alexander Robertson, *J.C.S.*, 1933, 489.

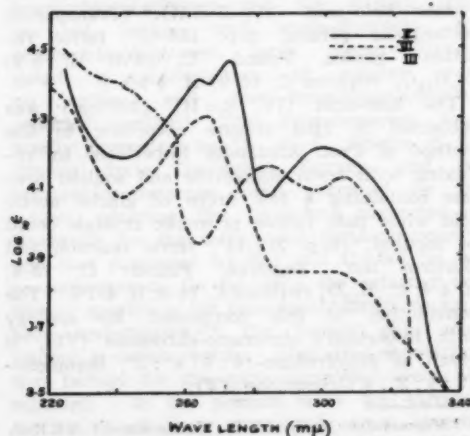


FIG. 1.

## THERMAL EXPANSION OF KCl AND KBr

VERY recently the coefficients of thermal expansion of a large number of crystals have been measured in the physical laboratories of the Indian Institute of Science, Bangalore. Amongst these, the results for KCl and KBr as given by Srinivasan<sup>1,2</sup> are of some interest. The thermal expansion coefficients of these crystals were calculated by me<sup>3</sup> in 1944 but no comparison with experiment was possible for lack of suitable data. In that work, I calculated the Gruneisen constants for all the frequencies as given by the Raman theory of crystal vibrations, from the known lattice forces in the ionic crystals. These constants, which were found to differ considerably from each other, were used to calculate the coefficients of the thermal expansion. Srinivasan's measurements make it possible to compare the results of the theoretical calculations carried out at that time with the experimental data. This comparison is given in Table I for the range of temperatures common to both.

TABLE I  
Theoretical and experimental coefficients of cubical expansion ( $\beta$ ) of KCl and KBr

Crystal	Temperature °T	$\beta \times 10^6$ Experimental	$\beta \times 10^6$ Theoretical
KBr	89	90.2	90
	140	96.5	101
	194	103.2	106
	273	108.0	112
	323	119.0	116
KCl	140	83	93
	194	98.5	101
	273	108	109
	323	114	112

Srinivasan claims an accuracy of 3% in his experimental values while in some cases his results differ by about 5% from those of other recent workers. Considering these factors the agreement between theoretical and experimental results is as close as is possible.

This gives a confidence in the method adopted for the calculations of the coefficients of thermal expansion and also shows that the Gruneisen constant is different for each frequency. In fact it was found to vary from 6 to 2.5.

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1. Srinivasan, R., *J. Ind. Inst. Sci.*, 1955, **37**, 232.
2. —, *Ibid.*, 1956, **38**, 20.
3. Dayal, B., *Proc. Ind. Acad. Sci.*, 1944, **29 A**, 70.

## CHEMICAL AND PHARMACOLOGICAL INVESTIGATION OF ROOTS OF WAGATEA SPICATA DALZELL

*Wagatea spicata* Dalzell (N.O. Leguminosae, Vernacular: *Vakeri*, *Vagati*) is a robust woody climber growing abundantly in Bombay State, especially in Konkan jungles and on the Ghats near Mahabaleshwar.<sup>1</sup> It is often confused with *Caesalpinia digyna* Rottler which belongs to the same natural order and has the same vernacular name. However, *Wagatea spicata* Dalzell is distinctly different from *Caesalpinia digyna*, Rottler in its botanical description. *Caesalpinia digyna* Rottler is not common in Bombay.

The root of *Wagatea spicata* Dalzell is known to be used in the cases of pneumonia<sup>2,3</sup> and frequently in the treatment of pulmonary tuberculosis like that of the root of *Caesalpinia digyna* Rottler. As no references are available in the literature about its chemical and pharmacological investigation, a study of the plant has been undertaken.

From 3 kg. of the dried powdered roots (collected near Mahabaleshwar, Bombay) a crystalline substance was isolated in a yield of 2%, by concentrating the alcohol extract under reduced pressure and crystallising the separated white solid mass from 20% alcohol. The m.p. and other chemical properties of the substance and its acetyl derivative were found to be identical with vakerine and its penta-acetyl derivative respectively isolated from *Caesalpinia digyna* Rottler by Chaudhry, Sharma and Dhar.<sup>4</sup> It has the molecular formula  $C_{15}H_{18}O_{10}$  and is found to contain one molecule of water of crystallisation.

The ultraviolet and infrared spectra of vakerine showed strong hydroxyl absorption which was absent in its penta-acetate indicating that all the hydroxyl groups had been acetylated. The infrared spectrum also suggested the presence of an enolysable ketone group in the compound which appeared to have been acetylated in the acetyl derivative since the band at  $1707^{-1}$  cm. of a carbonyl group was absent in the spectrum of the acetyl derivative. The aromatic character of the compounds was not exhibited in the lower parts of the spectra below  $900^{-1}$  cm.

After separating the crystalline vakerine, the alcohol extract was defatted with petroleum ether (40-60° C.) by liquid-liquid extraction method and further extracted with ether in the same way. When the ether extract was concentrated, an amorphous white sterol-glycoside separated out. The yield was very small, m.p. 261-65° C.; Liebermann Burchard test: positive.

Vakerine was found to be non-toxic to white mice. White mice weighing between 27 g. to 30 g. tolerated doses of 1.2 g./kg. orally and 0.4 g./kg. intravenously. The substance had no effect on the blood pressure and on respiration of the anaesthetised (Chloralose, 80 mg./kg. I.V.) adult cat when administered intravenously even upto a dose of 20 mg./kg. Vakerine had no effect on the isolated intestine of guinea-pigs and uterus of rats. It did not antagonise the stimulating effects of histamine and acetylcholine on the isolated guinea-pig intestine suspended in oxygenated tyrode solution.

Vakerine failed to inhibit the growth of *E. coli*, *S. aureus* and *E. typhi* even in a concentration of 5 mg./ml.

The authors wish to express their sincere thanks to Prof. R. Norman Jones of the National Research Council, Ottawa, Canada, for taking infrared spectra of the compounds. Their thanks are also due to Dr. D. W. Soman for his keen interest in the work.

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1. Cooks, *The Flora of the Bombay Presidency*, Taylor and Francis, London, 1903, 1, 416.
2. Kirtikar, K. R. and Basu, B. D., *Indian Medicinal Plants*, Lalit Mohan Basu, Allahabad, 1933, 2, 863.
3. Chopra, R. N., *Indigenous Drugs of India*, The Art Press, 20, British Indian Street, Calcutta, 1933, p. 538.
4. Chaudhry, G. R., Sharma, V. N. and Dhar, M. L., *J. Sci. Ind. Res.*, 1954, 13B, 147.

### ESTIMATION OF ZINC AS OXALATE

Zinc cannot be estimated like calcium by adding excess of oxalate though their solubility products are of the same order. This may be due to the fact that zinc oxalate precipitated as above has a slightly higher proportion of zinc. Ward<sup>1</sup> and Elving and Lamkin<sup>2</sup> obtained satisfactory results by precipitating zinc oxalate from 75% acetic acid medium. The basic salt formation can be prevented by the use of small amounts of sulphuric acid and the solubility of zinc oxalate due to low pH suppressed by acetone as shown below.

To 25 ml. of an approximately 0.1 M zinc sulphate solution was added 0.5 to 3.0 ml. of 1 N sulphuric acid, 40 ml. of an approximately 0.1 M sodium oxalate with constant stirring, followed by 30 ml. of acetone, and the required amount of water to make the volume to 100 ml. The precipitate, along with the supernatant liquid, after being heated over a water-bath at

70° to 80° C. for two hours, was filtered through a G<sub>4</sub> glass sintered funnel, washed with a 30% solution of acetone until it is free from the oxalate and finally washed twice with small volumes of water. The precipitate was then dissolved in hot 4 N sulphuric acid and the oxalic acid liberated was titrated against standard permanganate. In blank experiments the same volumes of zinc sulphate, sulphuric acid and sodium oxalate without the addition of acetone, was diluted to 100 ml. and the pH of the supernatant liquid was measured by a glass electrode.

TABLE I

pH of the medium if water is used instead of acetone	Millequivalents of permanganate required in triplicate experiments	Zinc in grams	
		Found	Taken
1.6	5.088, 5.088, 5.088	0.1663	0.1677
2.04	4.915, 4.915, 4.915	0.1607	0.1615
2.6	5.117, 5.117, 5.117	0.1673	0.1677
3.1	4.927, 4.927, 4.921	0.1611	0.1615
4.2	4.868, 4.868, 4.873	0.1592	0.1615

The results given in Table I indicate that the best results are obtained when the pH of the medium, measured as above, is near about 3, i.e., when 1.5 to 2.0 ml. of 1 N sulphuric acid is used. It may be noted that if the percentage of acetone by volume is about 35, zinc sulphate itself precipitates out.

The details of the investigation will be published elsewhere.

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1. Ward, H. L., *Amer. J. Sci.*, 1912, 33 (4), 334.
2. Elving, P. J. and Lamkins, J. C., *Ind. Eng. Chem. Anal. Ed.*, 1944, 16, 194.

### CHEMICAL COMPOSITION OF IPOMEA PALMATA AND PHARMACO- LOGY OF ITS EXTRACTS

*Ipomea palmata*, commonly known as railway creeper (Hindi—Kaladana), is a perennial twiner which is cultivated throughout India especially in the warmer parts for ornamental purposes. Its seeds are mostly used as purgative. The seeds yield 11.5% oil containing palmitic, stearic, arachidic, behenic, oleic, linolic acids and  $\beta$ -sitosterole.<sup>1</sup>

In order to find the active principles in the seeds responsible for the therapeutic activity of

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the drug, its alcoholic extract was investigated. Two kilos of the seeds were extracted with alcohol when a semi-solid extract in 10.5% yield was obtained. It was freed from oil with petroleum ether and the remaining mass was extracted with benzene. Solvent was removed and the residue (3.3%) was worked according to the method of Misra and Tiwari<sup>2</sup> employed for the isolation of muricatin A from *Ipomea muricata*. A pale yellow product was obtained which melted at 118-19° C. when dried at 100° C. It resembled muricatin A in all respects. The glucoside was subjected to alkaline hydrolysis in ethyl alcohol, this on subsequent acidification and extraction with ether yielded a colourless product, m.p. 104-06° C. This resembled muricatin B in all its properties.

In order to study the alleged purgative activity of the drug alcoholic extract of the seeds, its fixed oil and of muricatin A was tried in albino rats. The extract in a dose of 2 mg./kg. produced mild purgative action and the active principle in a dose of 0.5 g./kg. body weight showed well-marked purgative activity while the fixed oil from the seeds showed no such action.

A number of pharmacodynamic experiments were also put to observe the effect of both muricatin A and B on blood pressure, respiration and intestinal movements. Muricatin A in doses from 5 to 10 mg./kg., given intravenously to anaesthetised dogs, did not produce any marked physiological effect. But doses from 20 to 40 mg./kg. produced fall of blood pressure with subsequent rise to the original level. The intestinal movements were slightly relaxed.

The glucoside has no effect on isolated segments of rabbit intestine in small doses, but appreciable inhibition of contraction was observed with concentrations of 1 in 10,000. Muricatin B did not show any pharmacological activity.

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1. Handa, K. L., Vishwapal and Vasudev, *J. Sci., Indus. Res.*, 1956, **15**, 727.
2. Misra, A. L. and Tiwari, J. D., *Indian J. Chem. Soc.*, **29**, 63.

### A NEW ROUTE TO $\alpha$ -METHYL- HOMOVERATRYLAMINE

$\alpha$ -METHYLHOMOVERATRYLAMINE is an important intermediate in the synthesis of a large number of analogues of naturally occurring alkaloids of the papavarine and aporphine groups. Methods

previously employed for the synthesis of this compound are comparatively more complicated. Fugisawa and Deguchi<sup>1</sup> have applied Leuckhart reaction to 3:4-methylenedioxybenzyl methyl ketone to get  $\alpha$ -methylhomopiperonylamine. In the present work, 3:4-dimethoxybenzyl methyl ketone has been subjected to Leuckhart reaction to give  $\alpha$ -methylhomoveratrylamine.

A mixture of 3:4-dimethoxyphenylacetone<sup>2,3</sup> (21 g.) and formamide (63 g.) was heated at 190° C. for 6 to 7 hr. and then cooled and diluted with water (100 ml.). It was then extracted with ethyl acetate, dried and the solvent removed. The residue was heated on the water-bath for 2 hr. with 1:1 hydrochloric acid (75 ml.) and methanol (6 ml.), cooled and the unreacted matter extracted off with ethyl acetate. The aqueous layer was then made alkaline with 20% sodium hydroxide solution with cooling, the separated amine extracted with ethyl acetate, dried and solvent removed. The amine was purified by distillation in vacuum, b.p. 148-50° C./3 mm.; yield, 9.5 g. (45%).

I am thankful to Dr. K. N. Menon for guidance.

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1. Fugisawa, T. and Deguchi, Y., *C.A.*, 1955, **49**, 10958 i.
2. Mannich and Jacobson, *Ber.*, 1910, **43**, 193.
3. Shepard, E. C., *et al.*, *J.A.C.S.*, 1952, **74**, 4611.

### FEATURES OF ANATOMICAL INTEREST IN THE ALIMENTARY CANAL OF *CHIROCENTRUS DORAB* (FORSKAL)

*CHIROCENTRIDÆ* is one of the most primitive families of the Teleostean fishes, and is represented by a single genus *Chirocentrus*, and a single species *Chirocentrus dorab* (Forsk.). This family is regarded to be closely related to Clupeidæ. Ridewood,<sup>1</sup> while working on the cranial osteology of the Clupeoid fishes remarks that "*Chirocentrus* agrees so closely in the structure of the skull with the Clupeidæ, that appeal must be made to other organs of the body for evidence to support the views of those who would make of it a distinct family, the *Chirocentridæ*." The present author<sup>2</sup> studied the air-bladder of *C. dorab* and found that it was exactly of the Clupeoid type, although the description of its anatomy differed widely in different works. The present work on the anatomy and histology of the

alimentary canal was taken up to establish further the relationship between Chirocentridae and Clupeidae. This study, contrary to the expectations, has revealed many features of considerable interest.

The alimentary canal is divisible into a laterally compressed buccal cavity, followed by the pharynx and oesophagus. The oesophagus is separated from the stomach by a slight constriction (Fig. 1). The oesophagus is lined by squamous epithelium whereas the stomach is lined by columnar cells accompanied with gastric glands. The stomach is not divisible into the cardiac and pyloric portions. It has a long blind sac and from its anterior end arises the intestine.

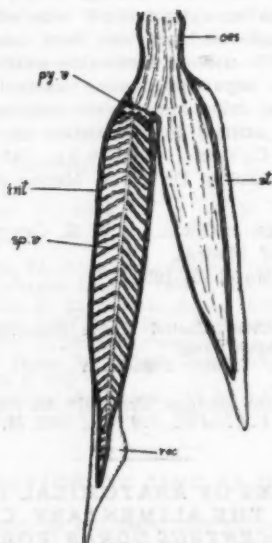


FIG. 1. Alimentary canal of *Chirocentrus dorab* Forskal), split open from ventral side.

int—intestine, oes—oesophagus; py.v.—pyloric valve; rec.—rectum; sp.v.—spiral valve; st—stomach.

At the junction of the intestine and stomach, there is a pyloric valve. The valve is simply the prolongation of the circular muscle fibres of the stomach. It is ring-like in shape and projects inwards. The intestine is straight, and as far as the author is aware such a straight intestine has not been found in any of the Teleostean fishes. The intestine is straight or nearly so in Cyclostomes, Elasmobranchs, Crossopterygii and Dipnoi. The mucous membrane of the intestine is folded into spiral valves. These valves are attached with the dorsal wall of the intestine. The intestine being short, these valves are meant to

increase the absorption surface and to check the easy passage of food. The presence of spiral valve has been described in Cyclostomes, Elasmobranchs, Amiidae, Holocephali, Chondrostei, Crossopterygii, Lepidosteidae and Dipnoi but has not been reported from any of the Teleostean fishes.

The intestine terminates into a short rectum. There is no marked histological difference between the intestine and the rectum which is simply a dilated portion of the intestine. Spiral valves are present in the rectum as well, although they are very feebly developed here. Further work is in progress.

Zoology Dept.,  
University of Allahabad,  
February 2, 1957.

P. N. SRIVASTAVA.

1. Ridewood, W. G., *Proc. Zool. Soc.*, London, 1904, 2, 448.
2. Srivastava, P. N., *Zool. Anz.*, Leipzig, 1956, 156, 284.

#### INTRACELLULAR BACTERIUM-LIKE MICRO-ORGANISMS OF *RHIZOPERTHA* *DOMINICA* F. (BOSTRYCHIDAE, COLEOPTERA)

IN *Rhizopertha dominica* F. two small spherical mycetomes are present in the fat bodies, one on each side of the alimentary canal. They lie dorsally near the anterior end of the proctodeum in the tergal region and contain bacterium-like micro-organisms. Mansour<sup>1,2</sup> while working on the location and morphology of these organisms and mycetomes, showed that in the adult male beetle the bacteria leave the mycetomes, invade the testes lobes, get mixed with the sperms and ultimately find their way into the body of the female during copulation where they infect the developing eggs. Although nothing is known about their physiology, the fact that they occur in all the individuals and that they are transmitted from one generation to another in such a complicated manner gives enough justification for considering them as symbiotes. Such a type of symbiosis has however been conclusively proved to occur in some other coleopterous insects<sup>3-5</sup> associated with stored plant products. Recently<sup>6,7</sup> it has been possible to eliminate symbiotes of *Rhizopertha* without adversely affecting the host.

During the work on the microbiology of this beetle we have been able to succeed in isolating and cultivating the symbiotes in an artificial medium outside the body of the host. The medium used was lactose-nutrient broth consisting of: beef extract, 3 g.; lactose, 5 g.; bac-

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teriological peptone, 5 g.; and distilled water, 1,000 ml. The pH was adjusted to 7.7-2. The egg-suspension was used as inoculum. The eggs for this purpose were externally sterilized for 20 minutes in a fluid recommended and used earlier by Begg and Sang<sup>8</sup> for *Drosophila* eggs. They were then treated with 70% ethanol and thoroughly washed with sterile water. The treated eggs were aseptically macerated in sterile water and the suspension was inoculated into lactose-nutrient-broth. After 24 hours of incubation at 37°C., growth appeared turning the broth turbid. The cultivated bacteria were of similar type as those found in egg-smears. These trials were repeated a number of times with similar results. It was also of interest to find that when 0-24-hr.-old eggs were used as inoculum the resultant bacteria consisted of bigger forms  $5 \times 1 \mu$  in size, rod-shaped and gram negative; but with 48-78-hr.-old eggs, smaller ( $2.5 \times 0.5 \mu$ ) forms were obtained although they retained the rod-shaped appearance and gram negative character. The same two forms were found in the egg-smears made out of the eggs of the two different age-groups. This is in agreement with Mansour's<sup>1</sup> observations on the polymorphism in the developmental cycle of the symbiotes. The symbiotes of *Oryzaephilus surinamensis* L. have also been cultivated artificially<sup>9</sup> in a similar manner.

Further work is in progress and details will appear elsewhere.

Our thanks are due to Prof. M. L. Bhatia for his keen interest in the work and facilities, and to Dr. B. D. Sanwal and Sri. E. A. Daniels for assistance.

Dept of Zoology,  
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Delhi-8, February 23, 1957.

N. C. PANT.\*

J. K. NAYAR.

MISS P. GUPTA.

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1. Mansour, K., *Quart. J. Micros. Sci.*, 1934, 77, 243.

2. —, *Ibid.*, 1934, 77, 255.

3. *La Symbiose des Insectes avec les Micro-organismes*, Union Internationale des Sciences Biologiques, Ser. B (Colloques), No. 10, 1952, 174 pp.; also, in *Tijdschr. Entomol.*, 1952, 95, 23.

4. Pant, N. C. and Fraenkel, G., *Biol. Bull.*, 1954, 107, 420.

5. —, *J. Zool. Soc. India*, 1954, 6, 173.

6. Huger, A., *Naturewissenschaften*, 1954, 41, 170.

7. —, *Dissertation*, Munchen, 1956.

8. Begg, M. and Sang, J., *Science*, 1950, 112, 11.

9. Pant, N. C., Nayar, J. K. and Gupta, P., *Experientia* (in press), 1957.

## CYTOLOGY OF SOME INDIAN SPECIES OF GENUS *ASPLENIUM* L.

ASPLENIACEAE is a very widely distributed family amongst Leptosporangiate Ferns and is typified by *Asplenium* L. This genus is represented throughout the world by about 700 recognized species.<sup>3</sup> Out of 32 species<sup>1</sup> of the genus met with in India, six are reported from Mussoorie, Western Himalayas.<sup>6</sup> All these species, namely, *Asplenium dalhousiae* Hook., *A. varians* Hook-Grev., *A. exiguum* Bedd., *A. trichomanes* Linn., *A. ensiforme* Wall., and *A. planicaule* Wall. were collected from Mussoorie Hills. Except the first species which is met with in India only in N.-W. Himalayas, all other species are also common in Western Ghats, South India.<sup>1</sup> The distribution range of all these is between 3,000-7,000 ft. The first four species are common and lithophytic while the last two species are quite rare in the area, and epiphytic, mainly on *Rhododendron arborescens* trees.

All of these were cytologically investigated on the spot with usual acetocarmine squash method. The meiotic chromosome number in each case is as follows:

*A. dalhousiae*,  $n = 36$ , Diploid (Fig. 1).



1



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FIG. 1. Diakinesis in spore mother-cell of *A. dalhousiae* showing  $n = 36$ ,  $\times 1,640$ .

FIG. 2. Diakinesis in spore mother-cell of *A. planicaule* showing  $n = 72$ ,  $\times 817$ .

*A. varians*,  $n = 36$ , Diploid.

*A. exiguum*,  $n = 72$ , Tetraploid.

*A. trichomanes*,  $n = 72$ , Tetraploid.

*A. ensiforme*,  $n = 72$ , Tetraploid.

*A. planicaule*,  $n = 72$ , Tetraploid (Fig. 2).

The authors could come across only tetraploid race of *A. trichomanes* from this area and this is in contrast to the fact that both the diploid and tetraploid races of this species are reported from Europe<sup>4</sup> and North America.<sup>2</sup> Since it is desirable to investigate each species from two geographically separate regions with different climate and rainfall, so study was made on *A. planicaule* and *A. ensiforme* also from Darjeeling, Eastern Himalayas. The other species are not met with in this area. Both were tetraploids like the plant growing in Mussoorie Hills. The bivalent chromosomes have usual configuration of X's, Y's, O's and V's. The meiosis is perfectly normal resulting in tetrads with well filled apparently viable spores. The spore output per sporangium in each case is 64. There is no sign of hybridity in any of the species. The basic chromosome number for the genus is 36, it being deeply seated in various species and confirms the results of Manton reported for large number of European and Ceylon species.<sup>4,5</sup> It can be inferred that intraspecific polyploidy is absent among species of genus met within this area and also that polyploidy is restricted only to the tetraploid level.

Botany Dept.,  
Panjab University,  
Amritsar, February 15, 1957.

P. N. MEHRA.  
S. S. BIR.

1. Beddome, R. H., *Handbook of the Ferns of British India, Ceylon and Malay Peninsula*, 1883, Calcutta.
2. Britton, D. M., *Amer. J. Bot.*, 1953, **40**, 575.
3. Copeland, E. B., *Genera Filicum*, 1947, Chronica Botanica, Waltham, Mass.
4. Manton, I., *Problems of Cytology and Evolution in Pteridophyta*, London, Camb. Univer. Press, 1950.
5. Manton, I. and Sledge, W. A., "Observations on the Cytology and Taxonomy of Pteridophyte Flora of Ceylon," *Phil. Trans. Roy. Bot. Soc. London*, 1954, **238 B**, 127.
6. Mehra, P. N., *Ferns of Mussoorie*, 1939, Lahore, Panjab Univer. Publ.

**PRISTOMERUS TESTACEACOLLIS  
CAMERON—A "NOMEN NUDUM"**  
(INSECTA: HYMENOPTERA, ICHNEU-  
MONIDAE)

My attention was drawn some years ago to an ichneumonid, *Pristomerus testaceacollis* Cameron, an endoparasite of the larvæ of *Holcocera pulverea* Meyr., and the confusion that existed regarding its true identity, by my father Shri S. N. Gupta of the Indian Lac Research Institute, Namkum, Ranchi. Later while working on the Oriental Ichneumonidae at Agra, I had occasion to study this species.

In the various reports and publications of the Indian Lac Research Institute, this species has been referred to as *Pristomerus marginicollis* Cameron and later as *P. testaceacollis* Cameron on the determination of Charles Ferriere,<sup>1</sup> then at the British Museum, London. An attempt to find the original description of *P. testaceacollis* proved futile. Consequently it was believed, as in the case of several other species of Cameron, to be a "nomen nudum"—a species which had never been described and of which only specimens remain in the collections of the British Museum. This view has now been confirmed by Dr. Charles Ferriere himself, at present at the Geneva Museum, by Miss L. M. Walkley of the U.S. National Museum and also by Mr. J. F. Perkins of the British Museum (Natural History). The name *Pristomerus testaceacollis* Cameron, therefore, has no value in literature and should not be considered.

Mr. Perkins informs me that *P. testaceacollis* Cam. (M.S.) "Type" from Borneo, is a completely distinct species from the one so determined by Ferriere from specimens from Namkum (P. M. Glover), as is also *P. marginicollis* Cam. It is, therefore, apparent that the *Pristomerus* species bred from lac has not so far been designated correctly.

Only two species of *Pristomerus* have been described till now from lac in India: *P. sulci* by Mahdihassan and Kolubajiv<sup>2</sup> and *P. laccæ* by Cushman.<sup>3</sup> Both these species come very close to the one found abundantly in lac at Ranchi. A comparison of the specimens collected at Ranchi with the type of *P. laccæ* Cushman at the U.S. National Museum, revealed very slight differences, which could be attributed to individual variations. The type of *P. sulci* is unfortunately not available. Nevertheless the published description of this species agrees very closely with my specimens, except for the size (stated by Mahdihassan and Kolubajiv<sup>2</sup> as 1 mm.), which I believe to be an error for 1 cm., as ichneumonids are never as small as that.

*Pristomerus* specimens from Ranchi, therefore, seem almost identical with *laccæ* Cushman and also with *sulci* Mahd. & Kol. All these species have been bred from lac and the host recorded is also the same, viz., *Holcocera pulverea* Meyr. It, therefore, appears that all the three species are identical and at the present stage, when our knowledge of the biology of these species is inadequate, these could not be held as different species. According to the International Code of Zoological Nomenclature, *Pristomerus sulci*, having been described earlier, takes precedence over *P. laccæ* Cush. The

species bred from the larvæ of *Holcocera pulvereæ*, a lepidopterous predator of lac should, therefore, be designated as *Pristomerus sulci* Mahd. & Kol.

Detailed results of my investigations and study, which were undertaken at the School of Entomology, St. John's College, Agra, are being published elsewhere. I am thankful to all the persons named above for their kind co-operation and help and to Dr. M. S. Mani and Dr. C. F. W. Muesebeck for facilities and encouragement.

Ranchi, Bihar,  
March 20, 1957.

V. K. GUPTA.\*

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1. *Annual Report*, 1931-32, *I.L.R.I.*, Namkum, Ranchi, 1932, p. 31.
2. Mahdihassan, S. and Kolubajiv, S., *Acta Soc. Ent. Czech.*, 1932, 29, 172-73, Fig.
3. Cushman, R. A., *Indian For. Rec. (Ent.)*, 1934, 20 (12), 5.

# AN AGROMYZID STEM FLY OF SAFFLOWER

DURING 1954, young plants of safflower, *Carthamus tinctorius*, were noticed dying with wilt-like symptoms. Affected plants showed the presence of agromyzid maggots boring the stems and branches. Symptoms appeared differently at different stages of plant growth. When the fly attacks young plants before branching, the portion above the site of attack slightly bends and the leaves appear droopy, giving the appearance of a wilted plant. In a couple of days the leaves dry and the entire plant dries up. This symptom is exhibited in the portion of the plant situated at or about the tunnel made by the maggot. In plants a little more grown and with a few more branches, the symptoms appear as drooping and yellowing of leaves, although the attack is in the main stem. If the attack is on a side branch, the symptoms will be similar to those exhibited by young plants. When the plant is mature, symptoms appear as yellowing of leaves and partial drying up of leaves from margin and tip downwards. If the tunnelling is in the branch bearing flower buds, such buds dry up without opening. No other portions of plant, excepting stem and branches, are attacked by the fly.

Due to tunnelling in hard and mature stems, swelling along the path of the tunnel are formed, appearing like small galls. This phenomenon, however, is not common and is seen mostly in varieties which are hardy. The mag-

got mines mostly in the pith region, sometimes cutting across the xylem. The tunnel may be straight or spiral. In certain cases tunnelling is found through all portions of the plant, and mines can be found anywhere on the plant upto the root zone. Mines vary in size, depending upon the larval instars which tunnel them. However, on an average, tunnels vary from 5 cm. to 9 cm. Frass is found in the tunnel. The maggot before pupation cuts a fine circular emergence hole, 0.75 mm. to 1 mm., in the stem, leaving only the epidermal layer intact. The maggot pupates near this hole. The fine epidermal layer over the emergence hole can clearly be seen as a shining transparent covering.

More damage is done to the young crop by killing the entire plants. The loss caused to the mature crop is only partial. The activity of fly is more intense from the second week of October to the third week of November, declining gradually. Random counting of attacked plants revealed the damage upto 5%. The fly is distributed throughout the erstwhile Hyderabad State.

Larva is robust and cylindrical. It is slightly yellowish white in colour and measures 5 mm. in length. The puparium is yellowish white, compact and cylindrical. It is 3 mm. to 4 mm. long and 0.5 mm. wide.

Adult is a medium size fly. It is dark with metallic blue. Halteres are black. The frontal lunule is large and the median carina is flattened and narrow. The fly is 2 mm. to 3 mm. long. Costa reaches  $M_1 + 2$ .  $M - M$  is present and is little more than its own length from  $R - M$ .

The fly is identified as *Melanagromyza* sp., belonging to the subfamily Agromyzinae and the family Agromyzidae.

Grateful acknowledgement is made to Dr. M. Q. Khan for facilities and help and Dr. Kenneth E. Frick for help in identification.

Plant Quarantine and Fumigation Station,  
Bombay, January 29, 1957.

## BACTERIAL SOFT-ROT OF CHICORY

CHICORY (*Cichorium intybus* L.) is being cultivated on a limited scale near Coimbatore for its root, which is used for blending coffee. During November-December 1956, there was a severe outbreak of root-rot of the crop. Field observations showed that the disease was more severe in the alkaline patches, ill-drained areas, and soils of poor fertility. Patches of diseased

plants were found distributed all over the field; in a patch, several infected plants showing all stages of the soft-rot of the roots were found. In general, the infection of the root was found to start from the tip of the root and proceed upwards (Fig. 1). In advanced stages, the



FIG. 1. Soft-rot affected (left) and healthy roots (right) of chicory.

whole plant, including the foliage, was found to rot, all the root tissues disintegrating in the soil. Microscopic examination of the diseased plants revealed the association of a bacterium with the disease. The bacterium was isolated, brought into pure culture and tested for its pathogenicity. On wound inoculation the isolate caused soft-rot of healthy chicory roots in 3 to 4 days, producing symptoms similar to those observed in the field. The organism was re-isolated from the artificially infected roots and was found to be identical with the original isolate. Based on its morphological, cultural, biochemical, and pathological properties, the bacterium is identified as *Erwinia carotovora* (Jones) Holland [Syn. *Bacterium carotovorum* (L. R. Jones) Lehmann and Neumann<sup>1</sup>]. A similar root-rot of chicory thought to be due to *Bacillus carotovorum* (Syn. *E. carotovora*) has been reported in Belgium by Marchal.<sup>2</sup>

The bacterium consists of short rods, 0.9 to 1.4  $\mu$   $\times$  1.8 to 3.6  $\mu$  in size. The rods are rarely in chains, actively motile, flagellate with peritrichous flagella, gram-negative, non-capsulated and non-sporing. On nutrient agar plates the organism produces in 24 to 48 hours circular colonies which are greyish white with glistening smooth surface and sharp margin. On potato plugs the growth is creamy white and the plugs become softened in 3 to 4 days. The nutrient broth becomes turbid within 24 hours,

and a yellowish sediment of the bacterial cells formed in 2 days. The broth becomes alkaline (pH 8.2) within 5 days. No soluble pigment is produced in both the solid and liquid media. There is only slight liquefaction of gelatin by the bacterium, but the litmus milk is coagulated in two days, with acid production and complete reduction of the litmus in 5 to 7 days accompanied by the separation of the whey. Nitrates are easily reduced, but no ammonia, indole or  $H_2S$  is produced by the organism. The bacterium also readily utilises glucose, maltose, xylose, rhamnose, sucrose, arabinose, levulose, raffinose, lactose, dextrose, galactose, starch, salicin and mannitol as carbon sources, but not glycerine. There is quick production of acid in all the media but little or no gas production in most of the media.

On artificial inoculation the isolate caused typical soft-rot of carrot, onion, radish, tomato, potato, and brinjal in 2 to 5 days in the laboratory.

I am thankful to Dr. K. Ramakrishnan for providing the facilities and for his interest in these studies, and to Sri. T. V. Subramanian and Sri. C. V. Govindasamy for helpful discussion.

Mycology and  
Plant Pathology Section,  
Agric. Res. Inst.,  
Lawley Road, Coimbatore,  
February 13, 1957.

G. RANGASWAMI.

1. Breed, R. S., Murray, E. G. D. and Parker Hitchens, A., *Bergey's Manual of Determinative Bacteriology*, 1948, VI Ed., Bailliere, Tindall & Cox, London.
2. Marchal, E., *Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, 1934, 3, 97-106. (*Rev. Appl. Mycol.*, 1934, 13, 492.)

### THE SPERMATOGONIAL CHROMOSOMES OF THE INDIAN RAT SNAKE *PTYAS MUCOSUS* LINN.

The spermatogonial chromosomes of *Ptyas mucosus*, consist of 34 elements, which fall into two distinct categories, i.e., macro- and micro-chromosomes (Fig. 1). The macro-chromosomes



FIG. 1. Polar view of Spermatogonial Metaphase.  $\times 4000$  (approx.).

are 16 in number and are generally seen scattered on the periphery of the equatorial plate. Of these 16 macro-chromosomes, 6 are V-shaped and 2 J-shaped, possessing median and sub-median spindle fibre attachment respectively and 8 are acrocentric, rod-shaped chromosomes. The micro-chromosomes consist of 18 dot-shaped bodies which generally occupy the centre of the equatorial plate and appear to possess terminal spindle fibre attachment. The chromosome complement of the male karyotype of *Ptyas mucosus* is:

$$6 V's + 2 J's + 8 R's + 18 D's = 34$$

Of the series Aglypha and the sub-family Colubrinae, to which *Ptyas mucosus* belongs, the male chromosomes of eleven species of snakes have been studied so far by Matthey<sup>1,2</sup> and Nakamura.<sup>3-5</sup> Matthey<sup>1</sup> while studying the chromosomes of *Tropidonotus*, *Zamenis* and *Coronella*, describes karyotypes which closely resemble the karyotype found in *Ptyas mucosus*. For all of them, Matthey<sup>1</sup> assigns 36 chromosomes which consist of 8 V's, 8 R's and 20 D's. The karyotype of *Ptyas mucosus* differs from the karyotype of *Zamenis*, to which it is closely related, in having two dot-shaped micro-chromosomes fewer.

Nakamura,<sup>3-5</sup> on the other hand, while working on the chromosomes of *Elaphe*, *Holarchus* and *Zoacys* (all belonging to the sub-family Colubrinae) also finds in all of them, 36 chromosomes; but all these have different proportions of the various morphological types of chromosomes, namely, 10 V's, 6 R's and 20 D's.

By applying Robertson's<sup>6</sup> Law, Nakamura<sup>5</sup> calculates the hypothetical chromosome number to be 46 for each of the abovementioned snakes. According to this law, the hypothetical chromosome number for the snakes which have been studied by Matthey<sup>1</sup> should be 44 and for *Ptyas mucosus*, 42.

Nakamura,<sup>5</sup> on the basis of his studies, formulates 10 V's + 6 R's + 20 D's, to be the fundamental chromosome complex for snakes, specifically so for the members of the families Colubridae and Viperidae. Further, judging from the figures of Matthey<sup>1</sup> he is of the opinion that there are present 10 V-shaped chromosomes in the karyotypes of *Tropidonotus*, *Zamenis*, *Coronella* and *Tarbophis*, and not 8 as described by Matthey<sup>1</sup> and later includes all of these in his charts and tables which illustrate the phylogenetic development of chromosome complexes in the families Colubridae and Viperidae. I feel that Nakamura is not much justified in having included *Tropidonotus* and

*Zamenis*, etc., in his scheme of the phylogenetic development of chromosome complexes, just by labelling some of the rod-shaped chromosomes as V-shaped ones. Further, the karyotype of *Ptyas mucosus* cannot be accommodated either hypothetically or by taking into account the number of V-, R- and D-shaped chromosomes, with the formula which is put forward by Nakamura<sup>5</sup> although *Ptyas* is also closely related to *Zoacys* (Smith<sup>7</sup>). On the other hand, the results obtained by me go a long way to support Matthey.<sup>1</sup>

Furthermore, I find that the karyotype of *Ptyas mucosus* presents the smallest number of chromosomes ever reported from the sub-order Serpentes.

I am much thankful to Prof. M. D. L. Srivastava, for his valuable criticism and guidance.

Dept. of Zoology,

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University of Allahabad,

Allahabad, January 16, 1957.

1. Matthey, R., *Rev. Suisse Zool.*, 1931, **38**, 117.
2. —, *Ibid.*, 1933, **40**.
3. Nakamura, K., *Proc. Imp. Acad.* (Tokyo), 1927, **3**, 296.
4. —, *Mem. Coll. Sci.*, Kyoto Imp. Univ., 1928, **4**, 1.
5. —, *Ibid.*, 1935, **10**, 361.
6. Robertson, Wm. R. B., *J. Morph.*, 1916, **27**, 179.
7. Smith, M. A., *Fauna of British India, Rep. and Amph.*, 1943, **3**.

#### RELATIONSHIP BETWEEN THE BODY WEIGHT AND THE OXYGEN CONSUMPTION IN *EMERITA ASIATICA* (MILNE EDWARDS)

THERE appears to be a general relationship between metabolic rate and body weight in animals. The metabolic rate per unit weight of the animal is found to decrease with increasing body weight. This relationship has also been investigated in various crustaceans of the temperate regions. Edwards and Irving,<sup>1</sup> working on *Emerita talpoidea*, observed a similar relationship. Later Zeuthen<sup>2</sup> who investigated the oxygen consumption in several poikilotherms observed that this relationship between body weight and metabolic rate can be expressed by the formula  $y = ax^b$ , where  $y$  is the rate of oxygen consumption and  $x$  is the body weight and  $a$  and  $b$  are constants; the latter may be called the exponent of the relation.

Since very little work has been done on the respiration of tropical crustaceans it was thought worthwhile to examine this relationship in the sand crab of Madras, *Emerita asiatica*.

Specimens brought from the seashore in lots of 15, were kept in large tanks at  $28.5 \pm 0.5^\circ \text{C}$ . in sea-water with a layer of sand at the bottom. Only non-ovigerous females of different sizes, which were starved for 24 hours, were used in the experiments. The experiments were conducted in fresh filtered sea-water. Only one animal was introduced into the experimental chamber, and after one hour the total oxygen consumption was estimated from the difference in the oxygen content in the chamber, at the beginning and at the end of this period. Oxygen content was estimated by Winkler's method. During experiments, the temperature of the chambers was maintained at  $28.5^\circ \text{C}$ ., by immersing them in a water-bath. Since the object of this investigation was to estimate the standard metabolism, no readings were taken when the sand crabs were swimming very actively.

The data are presented in Table I and illustrated by Fig. 1.

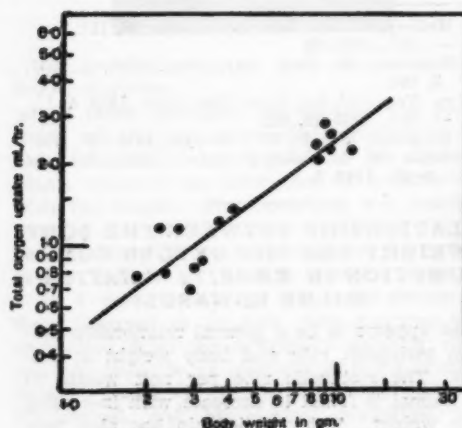


FIG. 1

Following Zeuthen, the data have been dealt with according to the exponential law  $y = ax^b$ . Adopting the "method of least squares" and constructing the normal equations and solving for  $a$  and  $b$ , the straight line  $\log y = -0.3527 + 0.7426 \log x$ , was found to fit the data. The total metabolism measured from the rate of oxygen uptake is found proportional to 0.743 power of the body weight.

It is of interest to note that the exponent 0.743 in the sand crab *Emerita asiatica* at  $28.5^\circ \text{C}$ . agrees very well with the previous observations on other crustaceans of the temperate waters. Weymouth<sup>3</sup> found the exponent

TABLE I  
Showing the oxygen consumption and the body weight in *Emerita asiatica* (Milne Edwards) at  $28.5^\circ \text{C}$ .

No.	Body weight (x) g.	Total oxygen uptake (y) ml./hr.	Rate of oxygen uptake ml./hr./g.
1	1.880	0.764	0.4064
2	2.260	1.151	0.5093
3	2.395	0.799	0.3336
4	2.695	1.140	0.4230
5	2.925	0.681	0.2328
6	3.025	0.822	0.2717
7	3.105	0.862	0.2776
8	3.785	1.219	0.3221
9	4.220	1.351	0.3201
10	8.450	2.338	0.2885
11	8.580	2.065	0.2407
12	9.005	2.766	0.3072
13	9.462	2.262	0.2391
14	9.720	2.523	0.2580
15	10.140	2.237	0.2201

to be 0.798 at  $15^\circ \text{C}$ ., in *Pugettia producta*. In other crustaceans ranging in size from the smallest species (*Branchinecta paludosa*), to the largest (*Sesarma ricardi*), Scholander<sup>4</sup> observed the exponent to be 0.850; Zeuthen obtained the exponent of 0.80 at  $16^\circ \text{C}$ ., in the marine micro fauna ranging in size from above 0.1 g.; Clark<sup>5</sup> found the exponent to be 0.836 in the land isopod *Talitrus sylvaticus* at  $25^\circ \text{C}$ .; and Ellenby<sup>6</sup> obtained 0.726 as the exponent in *Ligia oceanica*.

It would therefore appear that in crustaceans, the variation of the metabolic rate is close to the 0.8 power of the body weight, irrespective of the temperature.

My thanks are due to Dr. C. P. Gnanamuthu for suggesting the investigation, and to Dr. S. V. Job for his valuable suggestions, and to Shri K. Krishna Rao for a discussion of the statistical part of the study.

C. B. SUBRAHMANYAM.

Zoological Res. Lab.,  
University of Madras,  
Chepauk, Madras-5,  
March 4, 1957.

1. Edwards, G. A. and Irving, L., *J. Cell. and Comp. Physiol.*, 1943, **21**, 169.
2. Zeuthen, Eric, *Quart. Rev. Biol.*, 1953, **28**, 1.
3. Weymouth, F. W., *Physiol. Zool.*, 1944, **17**, 50.
4. Scholander, P. F. et al., *Ibid.*, 1953, **26**, 67.
5. Clark, D. P., *Biol. Bull.*, 1955, **108**, 253.
6. Ellenby, C., *J. Exptl. Zool.*, 1951, **28**, 492.

**TEST FOR MINERAL OIL IN EDIBLE  
OILS AND GHEE**

THE production of a highly refined and comparatively thin mineral oil known in commerce as 'white oil' has given an opportunity to the vendors of edible oils and ghee to adulterate their products with this cheap article. Mineral oils of various thickness and refractive indices have come into the market. Though it is possible to admix these mineral oils with all edible oils and ghee, coconut oil has specially attracted the attention of the oil manufacturers and vendors for adulteration.

Holde's Test for the detection of paraffin<sup>1</sup> was tried. While this test detects even small admixtures of paraffin wax and liquid paraffin of B.P. standards of specific gravity and viscosity, it was found to be of no use in detecting even 10% of white oil in admixture with coconut oil. For mixtures containing 5% and less, the test was practically useless.

Mixtures of ethyl alcohol and water in various proportions were successfully substituted for distilled water in Holde's test. Experiments made with 30, 50 and 70% alcohol showed that 50% alcohol was the most suitable and 70% alcohol second best. The following procedure was devised and is now used as a routine test in our laboratory for the detection of mineral oil in edible oils. The method is applicable to all the common edible oils and ghee (butter-fat). As little as 1% admixture with even the thinnest of mineral oils is detectable by this test.

**Procedure.**—One ml. of the filtered oil or fat (in the case of fats like ghee the fat is to be melted and filtered in an air-oven maintained at 60°C.) is taken in a 150 ml. flat-bottomed flask and 5 ml. of 1.4 normal alcoholic potash (10 ml. of a stock 14 KOH solution made up to 100 ml. with 95% alcohol) are added. The oil is saponified by heating the mixture over a wire-gauze with a small Bunsen flame under a reflux condenser for 5 minutes. The contents are allowed to cool to laboratory temperature under reflux. One ml. of the cooled liquid is pipetted into a clean test-tube, 10 ml. of 50% alcohol added and the contents mixed well. A turbidity results if mineral oil is present. If necessary, a comparison may be made with a blank obtained from genuine coconut oil.

If the saponified mass solidifies on cooling, it may be melted by warming before pipetting for the final test.

Analytical Labs., V. VENKATACHALAM.  
Corporation of Madras, S. SUNDARAM.  
Madras-3, April 25, 1957.

1. *Analysis of Foods*, by A. L. Winton and K. B. Winton, John Wiley, 1947, p. 538.

**LIPID SPHEROIDS IN THE AGEING  
NERVE-CELLS OF FROG**

THE present work on the ageing spinal ganglion cells of the frog, *Rana tigrina*, was undertaken to ascertain the validity of Moussa and Banhawy's<sup>1</sup> claim that the "sudanophil bodies" of adult and old amphibian neurones originate from the argentophil canalicular "Golgi reticulum" of the neurones of the tadpole and young toad.

Freshly teased neurones of tadpoles as also those of young, adult and old frogs, investigated by phase-contrast microscopy, do not show any component in the cytoplasm which could be compared to the Golgi reticulum of the above authors. In fixed preparations, however, canal-like or irregularly rounded spaces appear in the cytoplasm, and they do not have any relation whatever to any of the cell inclusions observed in the living neurones. Their appearance readily suggests that they are artifacts (Casselmann and Baker<sup>2</sup>).

The neurones of the tadpole or of any other phase during the life of the frog, studied fresh under phase-contrast or in fixed material, clearly show prominent spheroids of varying sizes. Figs. 1 and 2 show the cell inclusions of

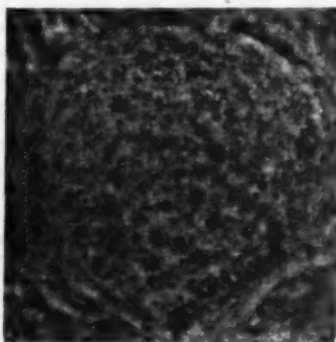


FIG. 1. Nerve-cell of tadpole,  $\times 1,600$ .

the living neurones of a tadpole and an old frog respectively.

The spheroids range in size from small homogeneous granules to big vesicles, each showing a chromophilic, osmiophilic and argentophilic

pellicle and a chromophobic core. The pellicle may be complete or incomplete, as described by Moussa and Banhaway<sup>1</sup>; and these spheroids are sudanophil, also in conformity with Moussa and Banhaway. They are coloured blue-black with Sudan black, whereas they lightly stain pink in Sudan IV, and stain blue with 1% Nile-blue after fixation in Regaud-post-chromed fixative. The spheroids are also preserved in cadmium-formaldehyde (Aoyama without silvering) preparations coloured by Sudan black. These reactions are true for the spheroids of all sizes of the neurones of tadpoles and frogs of all phases. It is, therefore, concluded that the osmiophil and argentophil bodies, which exist

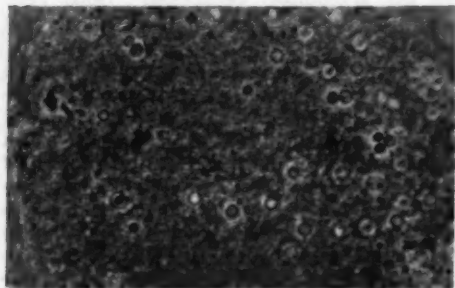


FIG. 2. Nerve-cell of old frog,  $\times 1,070$ .

as discrete spheroids in the neurones of tadpoles are morphologically and chemically the same structures as the spheroids of young, adult and old frogs except that the duplex spheroids are smaller in size and fewer in number in the tadpoles. They are also stainable vitally with neutral red. But there is no evidence that these sudanophil bodies originate from the

argentophil 'Golgi apparatus', as recorded by Moussa and Banhaway<sup>1</sup> and earlier by Gatenby *et al.*<sup>3</sup>

It is also concluded that the spheroids in neurones of vertebrates are identical with the lipid spheroids of invertebrate neurones, investigated by the author.<sup>4,5</sup> This is in accord with the conclusions of Thomas,<sup>6</sup> and Casselman and Baker.<sup>2</sup>

Pale yellow, chromophilic material, corresponding in origin to the "intraneuronal granules" of Thomas,<sup>7</sup> begins to accumulate in the core of the duplex spheroids in the adult neurones. The pellicle of the duplex spheroids, showing the condensation of this product ultimately completely disappears (Fig. 2), and the product often forms a diffused mass at one end of the neurone of the old animals.

Living neurones of the spinal cord of the tadpole, examined by phase-contrast microscopy, also show prominent refringent spheroids as described in the spinal ganglion cells, but the Golgi reticulum is never seen.

Zoology Dept.,  
Panjab University,  
Hoshiarpur, March 9, 1957.

S. K. MALHOTRA.

1. Moussa, T. A. and Banhaway, M., *J. Roy. Micro. Soc.*, 1954, **74**, 162.
2. Casselman, W. G. B. and Baker, J. R., *Quart. J. Micro. Sci.*, 1955, **96**, 49.
3. Gatenby, J. B., Moussa, T. A., Banhaway, M. and Gornall, J. I. K., *La Cellule*, 1953, **55**, 137.
4. Malhotra, S. K., *Quart. J. Micro. Sci.*, 1956, **97**, 177.
5. —, *Ibid.*, 1957, **98** (in press).
6. Thomas, O. L., *Ibid.*, 1948, **89**, 333.
7. —, *J. Comp. Neur.*, 1951, **95**, 73.

#### DEVICE FOR MEASURING RADIATION

A NEW and relatively inexpensive device for worldwide comparisons of X-ray measurements, intended eventually to contribute to uniform standards and to help control the medical irradiation of populations, will soon be made generally available through the co-operation of the United Nations Educational, Scientific and Cultural Organization, the World Health Organization, and the U.S. National Bureau of Standards.

Not only do many countries have no primary standards, but they have had no opportunity to check the standards they use against the primary standards in use in scientifically more advanced countries. To meet this problem, the National Bureau of Standards in Washington, D.C., has developed an ionization

chamber and accessory equipment that UNESCO and WHO will circulate to countries that request it. Specialists in the operation of the instruments will also be provided. The National Bureau of Standards plans to have the equipment available for circulation very shortly.

UNESCO plans to finance the use of the equipment in countries requesting it under the general programme of aid to member states. The cost of the equipment itself is small—of the order of \$2,500—and UNESCO now plans to purchase a second set from the National Bureau of Standards. In that case, one set probably could be sent to Asia for circulation among nations of that area.

## REVIEWS

Proceedings of the International Conference on the Peaceful Uses of Atomic Energy. Vol. 4. (Cross-sections Important to Reactor Design.) (United Nations Publication, New York), 1956. Pp. vii + 357. Price \$7.50.

One of the most important developments of the International Conference on the Peaceful Uses of Atomic Energy held in Geneva during August 1955 was the declassification by all countries of the fundamental cross-section information on which the reactor design is based. This volume includes technical papers and discussions of the measuring techniques and the results of measurements on all fissile and other reactor construction materials.

The first section is devoted to a review of crystal spectrometers, mechanical velocity selectors, choppers and pulsed accelerators being used in U.K., U.S.A. and U.S.S.R. Special electronic circuits for the measurement of milli-microsecond time intervals have been described. This section also includes a survey of the recent developments in neutron detection techniques, together with the methods employed for the determination of elastic and inelastic scattering cross-sections.

The second and third sections include measurements on the delayed neutrons and the values of cross-sections of fissionable and non-fissionable materials. The method of measuring very small absorption cross-sections by the pile oscillation method is described by Breton (France). The cross-sections for  $U^{235}$ ,  $U^{238}$  and  $Pu^{239}$  measured at several laboratories employing different techniques are presented. The world averages of the values of total and fission cross-sections of the above materials have been summed up by Hughes (U.S.A.). An exhaustive survey of the absorption cross-section of fission product poison  $Xe^{135}$  by Bernstein (U.S.A.) is included. The value of the fundamental cross-section of boron and gold is also presented. The last section deals with properties of fissionable materials. Results of the measurements of yield of fission neutrons, capture to fission ratio and the theoretical analysis of neutron resonances in fissile materials are presented.

This volume should prove of immense value to all neutron physicists.

V. P. DUGGAL.

The Cathode Ray Oscilloscope—Circuitry and Practical Applications. By J. Czech. (Philips Technical Library. Available from Philips Electrical Co., Ltd., 7, Justice Chandra Mahab Road, Calcutta-20), 1957. Pp. xii + 340. Price Rs. 29-4-0.

This book is broadly classified into four parts. In the first part, the theory of the design of an oscillograph is discussed in great detail. The various factors which affect the deflection sensitivity of the cathode ray beam and the maximum possible luminous intensity in the fluorescent screens used are described. The construction of the power supplies for the oscillograph and the various time-base generators, starting from the earliest neon saw-tooth generator to the more recent multivibrator and transitron Miller circuits, has been explained in a clear manner. Further, much attention is paid to the construction of deflection amplifiers which have a high and uniform amplification free from phase changes and amplitude distortions within a given frequency range. It would have been highly useful if some methods of obtaining very high amplification had also been described.

The second and third sections include measurements of amplitudes, frequencies and phases with an oscillograph. This part also deals with the applications of the oscillograph in A.C. bridge circuits and in the display of hysteresis loops. The book would be of greater value if applications of the following types had been included in this part: Investigations in radar systems; industrial applications such as the study of vibrations in machinery, pathological studies as in electro-cardiograms and electro-encephalograms.

In the third part, the author has presented the results of his measurements which are very important for familiarising one with the uses of the oscilloscope. The applications of the oscillograph in television and in recording the wave-forms of luminous flux, current and voltage of fluorescent lamps and flash bulbs are explained. Two standard methods of determining the opening time of camera shutters and their limits of applicability have also been discussed. The last part deals with the design technique of a simple oscilloscope and a simple time-base expansion unit.

The book is well got up, and the reproduction of a large number of figures and photographs enhances its value. Necessary references are cited, and a good index is given at the end of the book. It is hoped that this book will be a good introduction for those who are new to the technique of oscillography.

E. V. KRISHNAMURTHY.

**An Introduction to the Theory of Seismology.** Second Edition. By K. E. Bullen. (Cambridge University Press.) Pp. xv + 296. Price 35 sh.

This well-known volume by one of the important contributors to the development of seismology belongs to that admirable class of text-books which, within a brief compass, gives a wide authoritative coverage on important branches of natural science. A presentation of the elements of the Elasticity Theory and Vibrations is followed by the treatment of the propagation, reflection and refraction of bodily and surface elastic waves, the features of the Raleigh and Love waves and the reflected and refracted seismic waves. The spherically stratified earth models are treated for propagation of seismic rays and the resulting amplitudes of surface motion. The theory of the seismograph for horizontal and vertical motions, and a reference to the special types of Wood-Anderson, Galitzin, and Benioff is explained in relation to the general nature of the basic data in seismology. The different features of the seismograms, the construction of travel time tables for the main P-waves, and other phases and the general working of seismological observatories are briefly described.

Two illuminating chapters describe the properties of the earth's crustal layer, the mantle, and central core as derived from the extensive seismological data. The concluding chapters on earthquake occurrence and other topics include a description of energy, magnitudes, distribution, and after shocks with earthquakes of tectonic and other origins. By way of conclusion, reference is made to an era of expectancy arising from a substantial advance in the subject from studies of nuclear and thermo-nuclear detonations, but one has to be content with the author's advice of a patient wait for the unveiling of secrecy, in due course.

There is an extensive bibliography at the end of original contributions and classical works on the subject.

S. K. ROY.

S. L. BANERJI.

**Tables of Chemical Kinetics, Homogeneous Reactions.** (National Bureau of Standards Circular 510, Supplement 1, Issued November 14, 1956.) (Order from the Superintendent of Documents, U.S. Government Printing Office, Washington-25, D.C.) Pp. 472. Price \$ 3.25.

This volume is the first supplement to *Tables of Chemical Kinetics, Homogeneous Reactions* issued as NBS Circular 510 in 1951. Circular 510 and Supplement contain a critically evaluated compilation of the available numerical data on rates and rate constants of homogeneous chemical reactions. The emphasis is placed on experimentally ascertained facts, and data depending on interpretations are not generally included. The program is jointly sponsored by the Bureau, the National Research Council, and the Army Office of Ordnance Research.

Supplement I includes new tables, additions to the published tables, and revised sheets cancelling and replacing parts of the present tables. The tables are issued in the form of punched loose sheets which can be kept in a suitable loose-leaf binder. Further supplements will be issued as new or revised material warrants it.

**Advances in Carbohydrate Chemistry, Vol. 10** (Academic Press Inc., New York, N.Y.), 1955. Pp. xx + 437. Price \$ 10.50.

The present volume begins with a chapter on the stereochemistry of cyclic derivatives of carbohydrates. During the past decade, striking advances have been made in our knowledge of the stereochemistry of saturated rings, especially of six-membered rings. In this chapter the stereochemistry of six- and five-membered rings and of structures containing fused rings is first discussed in detail and this knowledge is applied to a study of the stabilities and transformations of several types of cyclic derivatives of carbohydrates. This chapter is well worth close study by all organic chemists interested in stereochemical problems. Chromatography has revolutionised sugar chemistry by making possible the analysis of complex mixtures encountered in degradative as well as synthetic studies and the second chapter gives a most useful account of the technique of column chromatography applied in the carbohydrate field. The next chapter gives an exhaustive account of glycosylamines, which are of great importance in many biological systems. The Amadori rearrangement which involves the isomerisation of an aldose to an

a 1-amino-1-deoxy-2-ketose forms the subject of another chapter. In view of the growing recognition of the usefulness of the Amadori rearrangement in several technical processes, this chapter will be found quite useful. Other chapters are devoted to the chemistry of glycosyl halides and their derivatives, of the methyl ethers of the aldopentoses, of the methyl ethers of D-galactose and of the polysaccharides associated with wood cellulose. The volume concludes with a critical summary of the present knowledge of the chemistry of heparin, the blood anti-coagulant factor. All the chapters are of uniformly high standard, and the volume will be a most useful addition to any chemical library.

T. R. GOVINDACHARI.

#### An Introduction to Modern Organic Analysis.

By Siggia and Stolten. (Interscience Publishers, New York), 1956. Pp. vii + 250. Price \$ 4.50.

The organic analyst is often confronted with problems which are inherently difficult, because of the extreme diversity of type and complexity of organic molecules. Most organic analytical problems require the application of diverse procedures, such as separation of pure components from a mixture, elemental analysis, analysis of functional groups and the measurement of physical characteristics. A book of about two hundred and fifty pages as the present volume under review, cannot ordinarily be expected to be of value as a practical manual of organic analysis, considering the vast scope of the subject. The authors have, however, succeeded in their objective of acquainting the reader with all the methods that may be of importance in the solution of organic analytical problems. The book may be said to fulfil this limited purpose quite well.

T. R. GOVINDACHARI.

**The Amphibia of Ceylon.** By P. Kirtisinghe. (Published by the author, 2, Charles Circus, Colombo-3, Ceylon), 1957. Pp. xiii + 112. Price not given.

The Amphibia rank next only to birds in their appeal to the naturalist in us. Their haunts are easily located, their habits are interesting to watch and they are easily reared as pests. Yet there are but few books wholly devoted to them and of these, those which combine a popular presentation along with scientific and precise descriptions are extremely scarce. Hence we are thankful to Dr. P. Kirtisinghe for giving us such a book.

From the many different accounts of the various forms collected and labelled in different museums and his study of his own personal collections and notes, the author has with infinite care identified each form which has been masquerading under more than one name and recognised the many forms which resemble and have borne the same name. This task requires not only patient and laborious examination of material and types—scientific work of a high order—but sound scholarship which will enable one to be sure of one's decision and differ, if necessary, from the opinion of earlier authorities like Kelaart, Gunther and Boulenger.

The author has listed 33 frogs and two caecelians, and has classified them into four families. His claim that 14 of them are Ceylonese is supported by the findings of earlier authors as well. The ten sub-species identified as such can be accepted and his identification of the remaining 23 species of anura are accurate. His classification is sound and up-to-date. One would have, however, wished for a fuller discussion or clarification of the reasons why he differs from earlier authors. To illustrate: Kirtisinghe considers *R. Eques* as a sub-species of *R. Cruciger* because of the resemblances he lists on page 10. Boulenger who has mentioned these resemblances, however, considers *R. Cruciger* as a species distinct from *R. Eques* because of nearly five features of difference. Again, Boulenger treats *Rhacophorus nasutus* as distinct from *Ixalus nasutus* and records both as Ceylonese. Why the author should accept *Rhacophorus* (*Philautus*) *nasutus* and omit the other could have been explained. Further, even Ahl, who has treated the *Rhacophoridae* at length and in detail, recognises *Philautus* as a subgenus of *Rhacophorus* and a brief comment why a generic status has been accorded to *Philautus* would have helped students of taxonomy.

The descriptions of the species are precise and clear and the notes on field identification packed with information. It is often forgotten by authors that a name alone is of little value but is incidental to a knowledge of the animal itself. But each of the 33 frogs Kirtisinghe has described, stands out clear and distinct in the reader's mind through descriptions and sketches of both the adults and larvae, in a way which leaves nothing more to be desired. Notes of the occurrence of each form in different parts of the island not only show the extent of the field work accomplished but enhances the value of the book to any resident of Ceylon.

The interest of the reader is excited even at the outset by the statement that it is very probable, that the 14 forms peculiar to Ceylon may have been evolved since the separation of the island from South India. While not questioning the value of such a statement in making the book readable, one who is painfully aware that our only account of the amphibia of India (namely, Boulenger's), is over 70 years old, would expect that intensive investigation of the amphibian fauna of especially South India (including Pondicherry, and native states), may yet reveal several which are at present recorded from Ceylon. The author's admission that *Bufo stomaticus* may be a recent immigrant implies the possibility of transportation and raises a doubt whether all the 14 forms now recorded only from Ceylon are autochthonous or recently evolved as claimed by the author. Taxonomy appears to be a very unreliable basis for such a generation.

On the whole, the author must be congratulated on his achievement. The book has an excellent get-up and the numerous illustrations enhance its value. Every college, university and public library should have this book on its shelves, both for the wealth of information between its covers, as well as to serve as a

model of a popular treatment of a very technical subject.  
C. P. GNANAMUTHU.

#### Books Received

*High Speed Diesel Engines.* By Arthur W. Judge. (Chapman & Hall), 1957. Pp. vii + 578. Price 65 sh.

*Pharmacognacy of Ayurvedic Drugs.* By K. Narayana Aiyar, A. N. Namboodiri and M. Kolamall. (The Central Research Institute University of Travancore, Trivandrum), 1957. Pp. 109. Price not given.

*Relaxation Methods in Theoretical Physics—The Oxford Engineering Series, Vol. II.* By R. V. Southwell. (Copies available from: Oxford University Press, Mount Road Madras-2), 1956. Pp. vi + 250-522. Price Rs. 44.

*Microphotography—Photography and Extreme Resolution.* By G. W. W. Stevens. (Chapman & Hall), 1957. Pp. xvi + 326. Price 50 sh.

*Fusion Methods in Chemical Microscopy.* By Walter C. McCrone Jr. (Interscience Pub.), 1957. Pp. vii + 307. Price \$ 6.75.

*Text-Book of Polymer Chemistry.* By Fred W. Billmeyer, Jr. (Interscience Pub.), 1957. Pp. viii + 518. Price \$ 10.50.

#### THE FIRST ONE HUNDRED AND FIFTY YEARS\*

**R**ANKING among the oldest publishing houses in the United States, the House of Wiley had its beginnings in a bookstore established at No. 6, Reade Street, New York City. The City Directory for the year 1807 lists Charles Wiley as the establishment's proprietor, and, in the absence of conclusive evidence proving an earlier founding, the business is considered to date from that year.

Charles Wiley, although initially a bookseller and printer, branched out into the publishing field prior to 1814 and, with various partners, printed the work of some of the best American and English authors of the period. Among these were James Fenimore Cooper and Fitz-Greene Halleck. Cooper's "The Spy", now considered one of the first great American novels, was published by Wiley and Halsted in 1821, at No. 3, Wall Street. Some of Cooper's later novels bore the Wiley imprint alone.

Charles Wiley died in 1828 and was succeeded by his son, John, whose name the Company now bears. Under John Wiley's supervision the busi-

ness progressed through a number of changes although his publishing interest continued to centre on books of a general literary nature. After the Civil War, Charles and William, two sons of John Wiley, joined the firm, which in 1875 became known as John Wiley & Sons. The younger of these, Major William H. Wiley, a Civil War veteran and civil engineering graduate, belongs much of the credit for carrying the Wiley name to the front rank in technical publishing at such an early date.

It was during the 70's and 80's that the firm began publication of the condensed engineering pocket works, which, over the years, have evolved into the tremendously comprehensive and useful handbooks of today.

By the time John Wiley & Sons was incorporated in 1904, with Major Wiley as the Corporation's first President, the publication of general literature had been virtually abandoned. In the years intervening to the present, the Wiley imprint became more and more associated with works of a scientific and educational nature, extensive coverage has been achieved in all major branches of engineering, the pure, applied, and social sciences, and in many collateral fields.

\* John Wiley and Sons, Inc., have brought out a tasteful volume with the above title, tracing the history of the firm from 1807 to 1957.

## SCIENCE NOTES AND NEWS

### Atomic Age Studies at Columbia University

Columbia University has announced the creation of a Council for Atomic Age Studies, with the objective of making the University a centre for the study of problems facing society as a result of the development of atomic energy, problems which in many instances overlap a number of fields of activity and different branches of learning. Fields of study represented on the Council itself include physics, engineering, medicine, international relations, journalism, business, philosophy and law. Prof. I. I. Rabi, Higgins Professor of Physics, and Prof. P. C. Jessup, Hamilton Fish Professor of International Law and Diplomacy, have been designated co-Chairmen.

The Council will initiate, organize and supervise studies drawing on the competence of many disciplines and activities of the University to examine some of the effects of the development of atomic energy on such diverse areas as industry, law, economics, foreign policy, international relations, agriculture, physical and mental health, domestic economy, city planning and community life. (The effects of such areas in turn on atomic development may also require study.)

### A 10,000-Million Volt Synchrotron

A proton synchrotron at the joint nuclear research institute at the town of Dubna, on the Volga about 150 miles from Moscow, has been put into operation and has already succeeded in accelerating protons to an energy of 8,300 million electron volts. The machine is designed to step up the energy of protons accelerated by it to 10,000 m. electron volts. This is possibly the most powerful apparatus now in existence for accelerating nuclear particles, to energise the highest ever artificially achieved.

Commenting in *Izvestia* on the importance of this new atomic machine, V. Veksler, Corresponding Member of the U.S.S.R. Academy of Sciences, and Director of the High Energy Physics Laboratory, gives figures showing the dimension and exceptional precision of this machine. The weight of its circular electromagnet is 36,000 tons, and the average diameter of the steel rim is nearly 200 feet. The pressure in the vacuum chamber where the parti-

cles are accelerated is lowered to one-thousandth millionth of an atmosphere with the help of 56 powerful pumps.

The magnetic field constantly affecting the particles in the chamber has been checked to a tenth of 1%. The experience that has been accumulated, it is added, warrants the construction of a still larger accelerator calculated to produce protons with an energy of 50,000 million electron volts.

### Borazon

The General Electric Company recently announced a new synthetic substance that compares with diamond in hardness. The substance, borazon, is a boron-nitrogen compound that is more resistant to heat than diamond, being able to withstand temperatures of more than 3,500° F., while diamond burns up at 1,600° F. Borazon was produced by applying pressures of one million pounds per square inch and temperatures of 3,000° F. Under these conditions the boron-nitrogen compound changes its crystalline form to that of a cube and is therefore called cubic boron nitride. Robert H. Wentworth of the General Electric Research Laboratory in Schenectady, N.Y., discovered borazon.

### World Directory of Crystallographers

The International Union of Crystallography is preparing a World Directory of Crystallographers, containing the names and addresses of all practising crystallographers, including advanced graduate students. It is hoped to compile a preliminary list in time for the Fourth General Assembly to be held in Montreal during July 10-17. The Secretaries of the National Committees (*Acta Cryst.*, 1955, 8, 857), have been asked to prepare a list of crystallographers in their countries. Some scientists and technologists, however, who carry on crystallographic work (including X-ray, electron or neutron diffraction and microscopy or other techniques) are not members of scientific societies having a unique crystallographic interest, and might therefore be missed. Those who come into this category are asked to send their names and addresses to Dr. W. Parrish, Philips Laboratories, Irvington-on-Hudson, New York.

**Gibberellic Acid for Research**

Small quantities of gibberellic acid are now being offered to research workers interested in plant growth stimulators, by Pfizer, Ltd., Folkestone. The Pfizer organisation produces gibberellic acid by fermentation processes.

Experimental evidence so far available in the U.S. indicates that gibberellic acid, when sprayed on plants or trees, can result in a doubling or trebling of linear growth in a few weeks. The effects are said to be most spectacular with 'dwarf' varieties, indicating an important association with genetic structure.

**U.S.-Soviet Co-operation**

The U.S. Government has offered to enter into an agreement with the U.S.S.R. under which Soviet and American planes would fly between Nome, Alaska, and Murmansk in the U.S.S.R. for observation of Arctic ice in connection with the International Geophysical Year. The reciprocal agreement would include exchanges of landing rights and the use of equipment, facilities, and personnel related to the flights.

At the Arctic Conference of the IGY in Stockholm in May 1956, the U.S. National Committee for the IGY had suggested co-ordination of the ice observation flights of the two countries. The Soviet representatives then proposed that alternate flights be exchanged in order to obtain a more comprehensive photographic record of the polar icepack and its changes.

**Dr. M. L. Roonwal**

Dr. M. L. Roonwal, Director, Zoological Survey of India, Calcutta, has been elected Presi-

dent, Zoological Society of India, for the period 1957-59. He has also been appointed a Member of the International Advisory Committee on Humid Tropics Research (UNESCO, Paris), and Hon. Secretary-General of the Indian Board for Wild Life.

**Decimal Coinage**

The introduction of decimal coinage in India from April 1, 1957, is the first step in the phased programme of switching over to the decimal system of currency, weights and measures.

The decision to change over to the decimal system was prompted by the rapid pace of industrialization in the country and the need for a rational mode of computation and measurement, in place of the prevailing systems which are far too many and wasteful of time and energy.

**Indian Society of Genetics and Plant Breeding**

At the Annual General Meeting of the Society held recently, the following Office-bearers were elected for the year 1957: *President*: Dr. B. P. Pal (New Delhi); *Vice-Presidents*: Dr. S. M. Sikka (New Delhi); Dr. R. H. Richharia (Sabour); *Secretary*: Dr. M. S. Swaminathan (New Delhi).

**Award of Research Degree**

The Ph.D. Degree of the University of Poona has been awarded to Shri Lakshman Vinayak Agashe for his thesis entitled "Dykes in Deccan Trap in a Region between Poona and Khadala" (Geology), and to Shri Madhukar Shripad Mate for his thesis entitled "Maratha Architecture" (Archæology).

**NOTICE**

**T**HE Editorial Office which was temporarily located at Madras-25 has now been transferred to Bangalore permanently.

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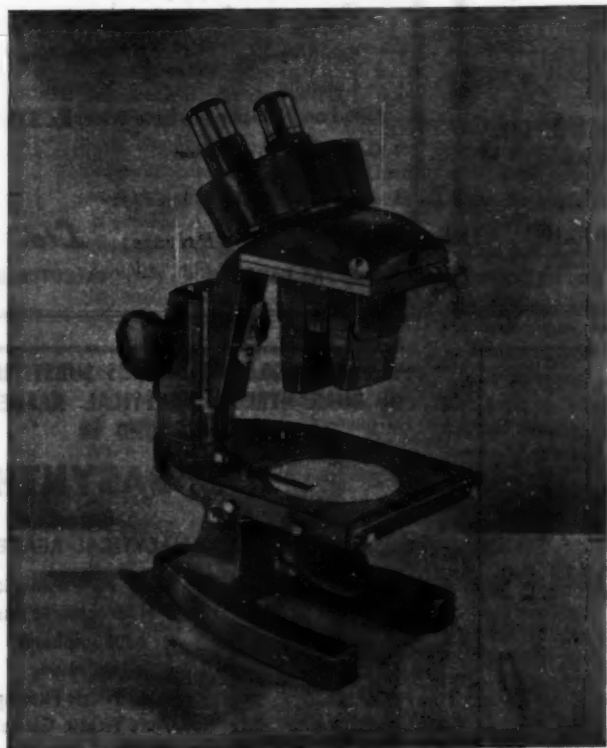
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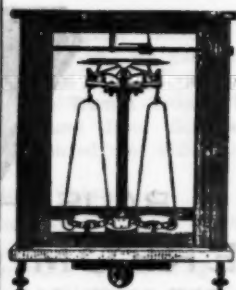
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